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AD 842359

Q 4018

IDEP FORM NO. 1A: 10-66

REPORT SUMMARY SHEET

1. COMPONENT/PART NAME PER GENERIC CODE	CAPACITORS, FIXED, FILM, HERMETICALLY SEALED, LEAD MOUNT
2. PROGRAM OR WEAPON SYSTEM	SIDEWINDER
ACCESS NUMBER	D0187
3. TEST COMPL. (MO./YR.)	10 66
REPT. COMPL. (MO./YR.)	1 67
4. ORIGINATOR'S REPORT TITLE	Laboratory Evaluation, Metallized Polycarbonate Capacitors
5. ORIGINATOR'S REPORT NO.	408-28-23-716
6. TEST TYPE, ETC.	QUALIFICATION
7. THIS TEST (SUPERSEDES) (SUPPLEMENTS) REPORT NO:	

8. ITEM	8A. PART TYPE, SIZE, RATING, LOT, ETC.	9. VENDOR & H4 CODE NO	10. VENDOR PART NO.	11. IND./GOV. STD. NO.	12. TOTAL TESTS
1	0.1 UF, 100V, 10401W2	TRW CAP 84411	483G		39
2					
3					
4					(OVER)

DDC OCT 31 1968 C

13: INTERNAL SPECS.ETC. REQ'D TO UTILIZE REPT.	ENCL	SENT WITH REPORT NO.	14. MIL. SPECS./STDS. REFERENCED IN 15C	
A			D	MIL-C-19978B
B			E	
C			F	

15A. B ITEM	TEST OR ENVIRONMENT	C PER SPEC	D SPEC. PARAGRAPH/ METHOD/CONDITION	E TEST LEVELS, DURATION AND OTHER DETAILS	F NO. TESTED	G NO. FAILED
all	Visual Examination	D	4.6.1		39	0
all	Seal	D	4.6.3	MIL-STD-202 Method 112, Condition A	39	0
all	Dielectric With	D	4.6.4	MIL-STD-202 Method 301,200% rated voltage	39	0
all	Barometric Pressure	D	4.6.5	MIL-STD-202 Method 105,200% rated voltage	12	0
all	Insulation Resistance	D	4.6.6	MIL-STD-202 Method 302, 100% rated voltage	39	1
all	Capacitance	D	4.6.7	MIL-STD-202 Method 305, Type 1610A	39	0
all	Dissipation Factor	D	4.6.8	MIL-STD-202 Method 305, Type 1650A	39	0
6	Shock	D	4.6.9	MIL-STD-202 Method 305, Condition C	6	0
6	Vibration	D	4.6.10	MIL-STD-202 Method 204, Condition B	6	0 (OVER)

D0187

16. SUMMARY OF REPORT, NATURE OF FAILURES AND CORRECTIVE ACTIONS TAKEN:

The capacitor manufactured by TRW met the essential requirements of the qualification test with the exception of the coefficient test.

~~STATEMENT #3 UNCLASSIFIED~~

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(OVER)

21. REPT. NO. 153.90.20.90.X7.03

17. TESTED BEYOND VENDOR CATALOG SPECIFICATIONS	18 VENDOR INFORMED BY COPY OF REPORT	19. SIGNED	20. CONTRACTOR	SUBCONTRACTOR
YES X	X	J. P. Higgins	NWC/CL.	ARINC Research

8. ITEM	8A. PART TYPE, SIZE, RATING, LOT, ETC.	9. VENDOR & H4 CODE NO	10. VENDOR PART NO.	11. IND./GOV. STD. NO.	12. TOTAL TESTED
5		----------			
6		----------			
7		----------			
8		----------			

15A. ITEM	TEST OR ENVIRONMENT	C PER SPEC	D SPEC. PARAGRAPH/ METHOD/CONDITION	E TEST LEVELS, DURATION AND OTHER DETAILS	F NO. TESTED	G NO. FAILED
6	Salt Spray	D	4.6.11	MIL-STD-202 Method 101, Condition B	6	0
6	Temp Cycling and Immersion	D	4.6.12	Method 102, Condition C MIL-STD-202 Method 104, Condition B	6	0
6	Solderability	D	4.6.13	MIL-STD-202, Method 208	6	2
6	Terminal Strength	D	4.6.14	MIL-STD-202, Method 211	6	0
6	Moisture Resistance	D	4.6.16	MIL-STD-202, Method 106	6	0
24	Low Temp	D	4.6.18	± 3% Change	24	0
24	Temp Coeff	D	4.6.19	200 PPM/°C	24	20
24	Life	D	4.6.20	125% Rated Voltage, 125°C	24	3

16. SUMMARY OF REPORT, NATURE OF FAILURES AND CORRECTIVE ACTIONS TAKEN:

Since TRW's capacitors failed to meet the temperature coefficient limit of 200 PPM/°C across the operating temperature range (-55° to 125°C), it was recommended that this test be revised to allow a maximum of ± 2% change in capacitance over the operating temperature range.

21 REPT. NO: 153.40.20.40-X7-03

3

NOTICES PAGE

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REPRODUCTION OF THIS REPORT

CONTENTS

CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

1. Description of Test Program

1.1 Purpose

The U. S. Naval Weapons Center, China Lake requested ARINC Research Corporation to conduct qualification testing, ~~based on MIL-C-19978-B,~~ of thirty nine metallized polycarbonate tubular capacitors, which were manufactured by Thompson Ramo Wooldridge.

1.2 Description of Test Units

Thirty nine (39) test specimens were selected at random from units obtained from inventory at NWC/CL. The manufacturer, TRW, did not have any prior knowledge of the qualification test. The capacitor types are described as follows:

Quantity	39
Type	483G
Capacitance, UF	0.10 ± 20%
Voltage rating, V	100
Case Size:	
Length, in.	0.812±0.062
Diameter, in.	0.400±0.015
Date Code	10401W2

2. Summary of Test Results and Recommendations

2.1 Results

TRW passed all of the qualification test with the following exceptions:

(a) Solderability test - 2 failures

(b) Operating life test - 3 failures
Two of the three operating life failures were apparently due to breaks in the hermetic seal, which resulted in a flow of impregnating oil to the outside. Visual examination indicated that the breaks were near crimped areas. The supplier has indicated that the practice of crimping is being discontinued.

(c) Temperature coefficient - 20 failures.

(d) 20 of 24 units failed the temperature coefficient test. Results of the temperature coefficient tests indicated that the polycarbonate capacitor is unable to satisfy the temperature coefficient requirement of 200 ppm/°C over the operating temperature range (-55° to +125°C). However, the test data indicated that the capacitors would meet a requirement that allows a maximum change of ±2%.

7

2.2 Recommendation

TRW is recommended as a qualified source in the following conditions:

(1) Crimping operation as now performed be eliminated from his assembly process, or satisfactory evidence is presented that it does not prejudice the reliability of the device.

(2) In the device specification, it is recommended that the parameter limits and test conditions contained in this qualification test (which is based primarily on the requirements of MIL-C-19978B) be used, with the following exceptions:

(a) Instead of a temperature coefficient of 200 ppm/°C over the operating temperature range (-55° to +125°C), it is recommended that a maximum capacitance change of ±2 percent from the room temperature reading be allowed.

(b) The following criteria should be used for denoting a failure in the operating life test:

(i) A change in capacitance of more than ±2 percent from the initial value (0 hours).

(ii) An increase in dissipation factor to greater than 0.30 percent.

(iii) A decrease in insulation resistance to a a value of less than 50 percent of the acceptance limits for +25° and +125°C.

(iv) A permanent open or short.

8

3. TEST EQUIPMENT AND PROCEDURE

3.1 Accuracy of Measurements

The accuracy of the measurements during the qualification testing is indicated below.

Parameter	Range of Values	Measurement Accuracy
Capacitance	0.1 uf ± 20%	0.5% ± 1 pf
Insulation resistance	1-1000 kMΩ	±2%
Dielectric withstanding voltage	200-400V	±2%
Dissipation factor	0.0001-0.1000	±5% ± 0.00001
Temperature	-65° to +125°C	±1°C
Frequency	1000 Hz	±2%

3.2 Measurement Techniques and Equipment

Measurement and test techniques are summarized below. Table 2 lists the various items of test equipment.

3.2.1 Group I: Examination and Parameter Tests

3.2.1.1 Detailed Examination of Device Construction

All failed units and two acceptable units were examined to determine:

(1) Method of construction

(2) Integrity of contacts between terminals and dielectric element

(3) Integrity of hermetic seal

(4) Workmanship and quality of construction.

The examination included visual inspection of both the outer and inner assembly of the devices, and x-ray analysis of assembly features.

TABLE 2

DESCRIPTION OF TEST EQUIPMENT*

Equipment Type	Manufacturer	Serial Number	Range	Accuracy	Calibration Date
Impedance Bridge Type 1650A	General Radio	7349	1 pf to 1000 uf	(±1%)+(±1 pf)	9/3/66
Differential Voltmeter Model 881AB	John Fluke	194	0 to 1100V	(±0.01%)+(±5V)	8/9/66
Voltmeter Model 410C	Hewlett-Packard	344-01215	±5 mV to ±1500V	±2% full-scale deflection	5/24/66
Temperature Chamber Model BTC700	Avonics Corp.	1068	-65° to +250°C	±1°C	n/a
Power Supply Model hp 711A	Hewlett-Packard	2134	0 to 500V	n/a	n/a

*See Appendix C for list of equipments used in environmental tests.

3.2.1.2 External Visual and Mechanical Examination

All 39 units were inspected for conformance to the physical dimensions and markings (part type and date code) specified in the supplier drawings. The workmanship was critically evaluated to point up those features which might be indicative of poor quality control or which might be detrimental to performance.

3.2.1.3 Seal

All 39 units were immersed for a minimum of one minute in oil maintained at a temperature of $125^{\circ} \pm 5^{\circ}C$, in accordance with method 112, test condition A, of MIL-STD-202. The bath was clear mineral oil having a Saybolt viscosity of 175 to 190 seconds at $38^{\circ}C$. The device was carefully observed during the entire period of immersion for indications of poor seal, as would be evidenced by a continuous discharge of bubbles. After the test was completed, the device was cleaned in a degreaser and permitted to dry thoroughly before additional tests were performed.

3.2.1.4 Dielectric Withstanding Voltage

The dielectric withstanding voltage was measured in accordance with method 301 of MIL-STD-202. The applied test voltage was twice the rated voltage for a duration of one minute. Measurements were taken between terminals and from the case to each terminal. A voltage breakdown, either permanent or momentary, during the one-minute period was recorded as a failure. The capacitors were visually examined for evidence of damage.

3.2.1.5 Barometric Pressure

Twelve units were tested in accordance with method 105 of MIL-STD-202. The following details were applied:

(1) Method of mounting: Soldering at points 1/2 ± 1/8 inch from the case.

(2) Test conditions: The capacitors were subjected to a pressure of 0.82 inches of mercury.

(3) Test during subjection to reduced pressure: A potential equal to that of 200 percent of the dc voltage rating was applied for at least one minute between each terminal and the case.

3.2.1.6 Insulation Resistance

Insulation resistance was measured in accordance with method 302 of MIL-STD-202. A test voltage equal to the device's rated voltage was applied for one minute. Measurements were taken between terminals and from the case to each terminal. The acceptable insulation resistance value was greater than 50 kilomegohms

for the test conducted at 25° ± 3°C, and 500 megohms for the test conducted at 125° ± 3°C.

3.2.1.7 Capacitance

The capacitance was measured, in accordance with method 305 of MIL-STD-202, on General Radio Impedance Bridge Type 1610A. The test frequency used was 1,000 ± 100 Hz. The acceptable limits were 0.10 uf ± 20 percent for devices having a 20 percent tolerance rating, and 0.10 uf ± 2 percent for devices having a 2 percent tolerance rating.

3.2.1.8 Dissipation Factor

The dissipation factor was measured at an ac rms voltage of 10 percent to 20 percent of the dc voltage rating, using the General Radio Impedance Bridge Type 1650A. The test frequency was 1,000 ± 100 Hz. The measured value was not to exceed 0.15 percent.

3.2.2 Group II: Environmental Tests

3.2.2.1 Shock

Six units were tested in accordance with method 205 of MIL-STD-202. The following details were applied:

(1) Mounting means: Soldering at points 1/2 ± 1/8 inch from the case.

(2) Test-condition letter: C.

(3) Electrical loading during shock: A potential of 125 percent of the dc voltage rating was applied between the terminals of the capacitor.

(4) Measurement during and after shock: During the environmental test, a cathode-ray oscilloscope was used as an indicating device in determining any electrical failures. After the test, the capacitors were visually examined for evidence of electrical breakdown, arcing, fracturing, or other visual mechanical damage.

When the capacitors were tested as specified above, there was to be no momentary or intermittent arcing or other indication of breakdown, nor was there to be any evidence of fractures or other visible mechanical damage.

3.2.2.2 Vibration

Six units were tested in accordance with method 204 of MIL-STD-202. The following details and exceptions were applied:

(a) Mounting: The capacitors were rigidly mounted by the body to a vibration-test apparatus. The capacitor leads were secured by soldering 1/2 ± 1/8 inch from the case.

(b) Electrical-load conditions: During the test, a potential of 125 percent of the dc voltage rating was applied between the terminals of the capacitor.

(c) Test-condition letter: B, with the following exception: Direction and duration of motion, four hours in each of two mutually perpendicular directions (total of eight hours), one parallel and the other perpendicular to the cylindrical axis.

(d) Measurements: During the last cycle in each direction, a signal of 1 ± 0.2 kc at a potential of 1 ± 0.5V was placed across the capacitor and measured with a suitable ac recording device (a permanent record was not necessary for this test) for the purpose of determining open or short circuits, or intermittent contacts. The equipment was capable of detecting any interruption of 0.5 millisecond or greater.

(e) Examination after vibration: The capacitors were visually examined for evidence of mechanical damage.

When the capacitors were tested as specified above, there was to be no momentary or intermittent arcing or other indication of breakdown, nor was there to be any open or short circuits or evidence of visible mechanical damage.

3.2.2.3 Salt Spray

Six units were tested in accordance with method 101 of MIL-STD-202. The following details applied:

(a) Test condition letter: B.

(b) Examination after exposure: The capacitors were visually examined for evidence of harmful corrosion, and obliteration of marking.

When the capacitors were tested as specified above, there was to be no evidence of harmful corrosion, and at least 90 percent of the exposed metallic surfaces of the capacitor had to be protected by the finish. In addition, corrosion of the terminal hardware was not to exceed 10 percent of the surface area. Marking was to remain legible.

3.2.2.4 Temperature Cycling and Immersion

Six samples were tested in accordance with methods 102 and 104 of MIL-STD-202. Test condition C of method 102 was used for the temperature cycling test. Within 24 hours after completion of the temperature cycling test, the immersion test was performed per test condition B of method 104.

Within 24 hours after completion of temperature cycling and immersion tests, the dielectric withstanding voltage and the

insulation resistance were measured as described in paragraphs 3.2.1.4 and 3.2.1.6. The samples were also examined for extensive corrosion or obliteration of marking on the casing. Failure of the unit to meet the specified limits of dielectric withstanding voltage or insulation resistance, or the presence of excessive corrosion or obliteration of marking on the unit, was cause for classifying the unit as a failure. The physical dimensions of the test units were also checked for any changes. A dimensional change of more than ±5 percent was recorded as a failure.

3.2.3 Group III: Mechanical Tests

3.2.3.1 Solderability

Six units were tested in accordance with method 208 of MIL-STD-202. The following details applied:

(a) Number of terminations to be tested: Both leads of the capacitors were subjected to the solderability test.

(b) Depth of immersion in flux and solder: The leads were immersed to within 1/8 inch of the capacitor body.

When the capacitors were tested as specified above, the dipped surface of the leads were at least 95 percent covered with a smooth, clean, shiny, continuous solder coating. Under the minimum acceptable conditions, the remaining 5 percent of the lead surface was to show only small pinholes, voids, or rough spots; these could not be concentrated in one area. No individual void in the solder coating could exceed the diameter of the lead. Bare base metal and areas where the solder dip failed to cover the original coating were indications of poor solderability, and thus cause for failure.

3.2.3.2 Terminal Strength

Six units were tested as follows:

The wire-lead terminals were bent through 90° at a point 1/4 inch from the body of the capacitor, with the radius of curvature at the bend approximately 1/32 inch. The terminals were clamped to within 3/64 ± 1/64 inch of the bend. The body of the capacitor or the clamped terminal was then rotated about the original axis of the bent terminal through 360°, in alternating directions, for three rotations at the rate of approximately 5 seconds per rotation.

When the capacitors were tested as specified above, there was to be no mechanical damage visible to the naked eye to either the capacitor or terminals.

3.2.3.3 Moisture Resistance

Six units were tested in accordance with method 106 of MIL-STD-202, with a polarization voltage of 50 percent of rated voltage.

After the final cycle of the moisture resistance test, the test units were conditioned at 25° ± 5°C and a relative humidity of 50 ± 5 percent for 24 hours. Within 24 hours after conditioning, the dielectric withstanding voltages and the insulation resistance and capacitance were measured at 25° ± 3°C as described in 3.2.1.4, 3.2.1.6, and 3.2.1.7 herein. The samples were then examined for excessive corrosion or obliteration of marking on the casing. Failure of the sample unit to meet the specified limits of dielectric withinstanding voltage and insulation resistance, or the presence of excessive corrosion or obliteration of marking on the unit sample, was cause for classifying the unit as a failure.

The physical dimensions of the test units were also checked for any change. A dimensional change greater than ±5 percent was recorded as a failure.

3.2.4 Group IV: Temperature and Life Tests

3.2.4.1 Low Temperature, and Capacitance Change with Temperature

Twenty-four samples were subjected to the test sequence discussed below.

The capacitors were placed in a conditioning chamber maintained at -65° +0°/-5°C, and a potential equal to the dc voltage rating was applied for 48 hours. The air within the chamber was circulated. At the conclusion of the low-temperature conditioning time, capacitance measurements were made at -65° +0°/-5°C, +25° ±5°C, +125° ± 5°C, and +25° ± 5°C. The -65°C measurement was made before the capacitors were removed from the conditioning chamber. The measurement at each temperature was recorded when two successive readings taken at 5-minute intervals indicated no appreciable change in capacitance (≥ ±0.5 percent). The capacitors were then visually examined for evidence of breakdown, arcing, open and short circuits, and other visible mechanical damage.

When the capacitors were tested as specified above, there was to be no indication of breakdown or arcing, no open or short circuitry, nor any visible evidence of mechanical damage. The capacitance changes at the specified temperatures could not exceed ±3 percent from the 25°C value.

3.2.4.2 Temperature Coefficient

Twenty-four samples were tested in the following manner:

Capacitance measurements were made after the capacitors were stabilized at each of the following temperature levels in the indicated order: +25°, -55°, -15°, +40°, +75°, +100°, +125°, and +25°C. Capacitor stability was indicated when no appreciable change (≥ ±0.5 percent) existed in two successive capacitance measurements made at five-minute intervals. The device was stabilized for a minimum of 30 minutes at each temperature before capacitance measurements were taken.

The temperature coefficient was computed from the following formula:

$$TC = \frac{(C_2 - C_1)\, 10^6}{(T_2 - T_1)\, C_1}$$

where :

TC = temperature coefficient in ppm/°C

C_1 = capacitance in uf at the first +25°C reading

C_2 = capacitance in uf at test temperature

T_1 = +25°C

T_2 = test temperature, °C

Those devices having a temperature coefficient of greater than 200 ppm/°C (0.02 %/°C) at any temperature level were considered to be failures.

3.2.4.3 Life Test

Twenty-four samples were subjected for 250 ± 8 hours to a dc potential of 140 percent of rated voltage at an ambient temperature of +125° ±2°C throughout the test. During the test, the capacitors were separated by a distance of not less than 1 inch. Adequate circulation of air was provided to prevent the temperature within six inches of any capacitor from departing more than ±2°C from the nominal ambient temperature (+125°C) of the chamber.

Measurement of the dissipation factor and capacitance parameters in accordance with procedures described in 3.2.1.7 and 3.2.1.8 were made at 50 ± 8 hour intervals during the test. The capacitors were permitted to stabilize at room temperature for a minimum of eight hours before measurement. In addition, the dissipation factor, capacitance, and insulation resistance parameters were measured prior to and at the conclusion of the life test, in accordance with the procedures described in 3.2.1.8, 3.2.1.7, and 3.2.1.6. Unit parameters failing to meet the limits specified in the referenced paragraphs were considered to be failures.

The test samples were also visually examined for leakage of impregnant and deformation of casing. Evidence of either condition was grounds for classifying the sample as a failure. The physical dimensions of the devices were also checked for any change. A dimensional change of greater than ±5 percent was recorded as a failure.

3.3 Testing Procedure

The overall testing procedure is summarized in Table 3, in which the tests are listed in the order performed.

3.4 Parameter Test Limits

The test limits shown in Table 4 were used in defining acceptable capacitor performance for the initial environmental and life tests performed. These limits are based on the requirements of MIL-C-19978B.

TABLE 3

QUALIFICATION TEST PLAN

Examination or Test	Ref. Para.	No. of Units	Defects Allowed	Test Limits	Remarks
GROUP I					
Visual and mechanical examination (internal) including material, design, construction, and workmanship.	3.2.1.1	2	0	n/a	Devices examined for functional design and level of workmanship; examination included metallography.
Visual and mechanical examination (external) including physical dimensions, marking and workmanship.	3.2.1.2	39	1	n/a	Devices examined for conformance to specified dimensions, marking, and level of workmanship.
Seal	3.2.1.3	39	1	n/a	When the capacitors were tested as specified in 3.2.1.3, there was to be no leakage of the impregnant ror a continuous stream of bubbles.
Dielectric withstanding voltage	3.2.1.4	39	1	n/a	Momentary or permanent breakdowns were considered as failures.
Barometric pressure	3.2.1.5	39	1	n/a	When tested as specified in 3.2.1.5 there was to be no momentary or intermittent arcing or other indication of breakdown.
Insulation resistance	3.2.1.6	39	1	50 kMΩ	—
Capacitance	3.2.1.7	39	1	0.080-0.120 uf 0.098-0.102 uf	Limits for 20 percent tolerance. Limits for 2 percent tolerance.
Dissipation factor	3.2.1.8	39	1	±0.15%	—

(Continued)

18

TABLE 3 (Continued)

Examination or Test	Ref. Para.	No. of Units	Defects Allowed	Test Limits	Remarks
GROUP II					
Shock, medium impact	3.2.2.1	6	1	n/a	Devices were monitored during testing for any open or short circuits or intermittent contacts. After testing, the capacitors were inspected for mechanical damage.
Vibration	3.2.2.2				
Salt spray	3.2.2.3				After testing, the capacitors were examined for corrosion or obliteration of marking.
Temperature cycling and immersion	3.2.2.4			See Remarks	The devices were tested for dielectric withstanding voltage and insulation resistance to limits listed in Group I above.
GROUP III					
Solderability	3.2.3.1	6	1	n/a	Tested in accordance with method 208 of MIL-STD-202.
Terminal strength	3.2.3.2				Examined for mechanical damage.
Moisture resistance	3.2.3.3			See Remarks	After this test, the capacitors were tested for dielectric withstanding voltage and insulation resistance to limits listed in Group I above.

(Continued)

TABLE 3 (Continued)

Examination or Test	Ref. Para.	No. of Units	Defects Allowed	Test Limits	Remarks
GROUP IV					
Low temperature, and capacitance change with temperature.	3.2.4.1	24	1	±3%	Change in capacitance.
Temperature coefficient	3.2.4.2			200 ppm/°C	
Life	3.2.4.3			0.080-0.120 uf	Limits for 20 percent tolerance.
				0.098-0.102 uf	Limits for 2 percent tolerance.
				50 kMΩ	Insulation resistance.
				n/a	Dielectric withstanding voltage. See Group I above.

TABLE 4

PARAMETER TEST LIMITS

All Types:	
Dissipation factor = 0.15%	
Insulation resistance = 50 kMΩ at +25°C, 500 MΩ at +125°C.	
Temperature coefficient = 200 ppm/°C	
Capacitance change (-65°C to +125°C) = ±3%	
Capacitor rating	0.1 uf ± 20% 100V
Capacitance limits:	
Min, uf	0.080
Max, uf	0.120

4. TEST RESULTS

Results of qualification testing of the test units types are discussed in the following paragraphs and summarized in Table 5.

4.1 Group I: Initial Measurements

4.1.1 Physical and Dimensional Examination

Dimensional measurements of the sample lot showed that all units were within the limits specified by the supplier. The specified dimensions are given in Figure A-1, Appendix A. Actual measurements are given in Appendix E.

The workmanship appeared to be generally adequate. The supplier crimps the metal sleeve to aid in soldering during assembly. This practice, while not appearing to affect the electrical characteristics of the capacitor, could induce strains in the package which might lead to rupture of the hermetic seal at a later date.

4.1.2 Hermetic Seal

No failures were recorded in the hermetic seal test for the sample lot seal.

4.1.3 Dielectric Withstanding Voltage

None of the test units failed the dielectric withstanding voltage test.

4.1.4 Barometric Pressure

There were no failures in the barometric pressure test. Test details appear in Appendix C.

4.1.5 Insulation Resistance

There was one room-temperature failure during the insulation resistance test. The distribution of insulation resistance values is shown in Figure 1. As can be seen from this plot, insulation resistance values for the test units were well above the specified 500-megohm minimum.

TABLE 5

TEST RESULTS

Test Paragraph	Description	Tested	Rejected	Remarks
3.2.1	Group I: Initial Measurements			
3.2.1.2	Mechanical examination	39	0	
3.2.1.3	Seal	39	0	
3.2.1.4	Dielectric withstanding voltage	39	0	
3.2.1.5	Barometric pressure	12	0	
3.2.1.6	Insulation resistance: +25°C +125°C	39 39	1 0	
3.2.1.7	Capacitance	39	0	
3.2.1.8	Dissipation factor	39	0	
3.2.2	Group II: Environmental Tests			
3.2.2.1	Shock	6	0	
3.2.2.2	Vibration	6	0	
3.2.2.3	Salt spray	6	0	
3.2.2.4	Temperature cycling and immersion	6	0	
3.2.3	Group III: Mechanical Tests			
3.2.3.1	Solderability	6	2	Poor solderability
3.2.3.2	Terminal strength	6	0	
3.2.3.3	Moisture resistance	6	0	
3.2.4	Group IV: Temperature and Life Tests			
3.2.4.1	Low temperature and capacitance change with temperature	24	0	
3.2.4.2	Temperature coefficient	24	20	
3.2.4.3	High-temperature operational life	24	3	1- Shorted 2- Leakage of oil due to defective hermetic seal

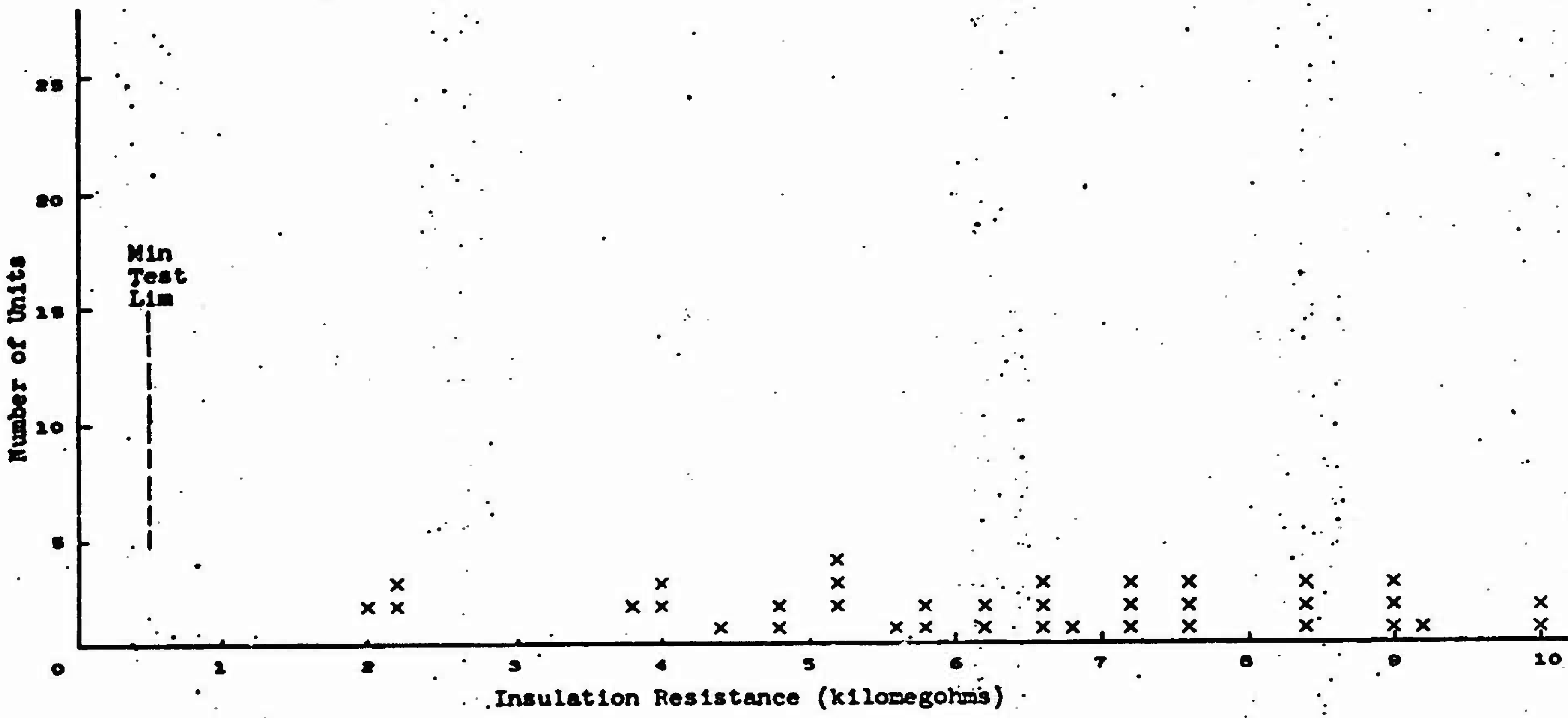


FIGURE 1

DISTRIBUTION OF INSULATION RESISTANCE VALUES AT HIGH TEMPERATURE (+125°C)

4.1.6 Capacitance

Capacitance values were well within specification for the sample lots. Figure 2 shows the distribution.

4.1.7 Dissipation Factor

Dissipation factors for all test units were within specification. A distribution plot for all test units is shown in Figure 3.

4.2 Group II: Environmental

4.2.1 Shock

No failures were recorded during the shock test.

4.2.2 Vibration

There were no failures during the vibration test.

4.2.3 Salt Spray

All test units were satisfactory.

4.2.4 Temperature Cycling and Immersion

All test units were satisfactory.

4.3 Group III: Mechanical Tests

4.3.1 Solderability

Two units failed the solderability test. The two failures were due to poor solderability of the capacitor leads.

4.3.2 Terminal Strength

No units failed the terminal strength test.

4.3.3 Moisture Resistance

No units failed the moisture resistance test.

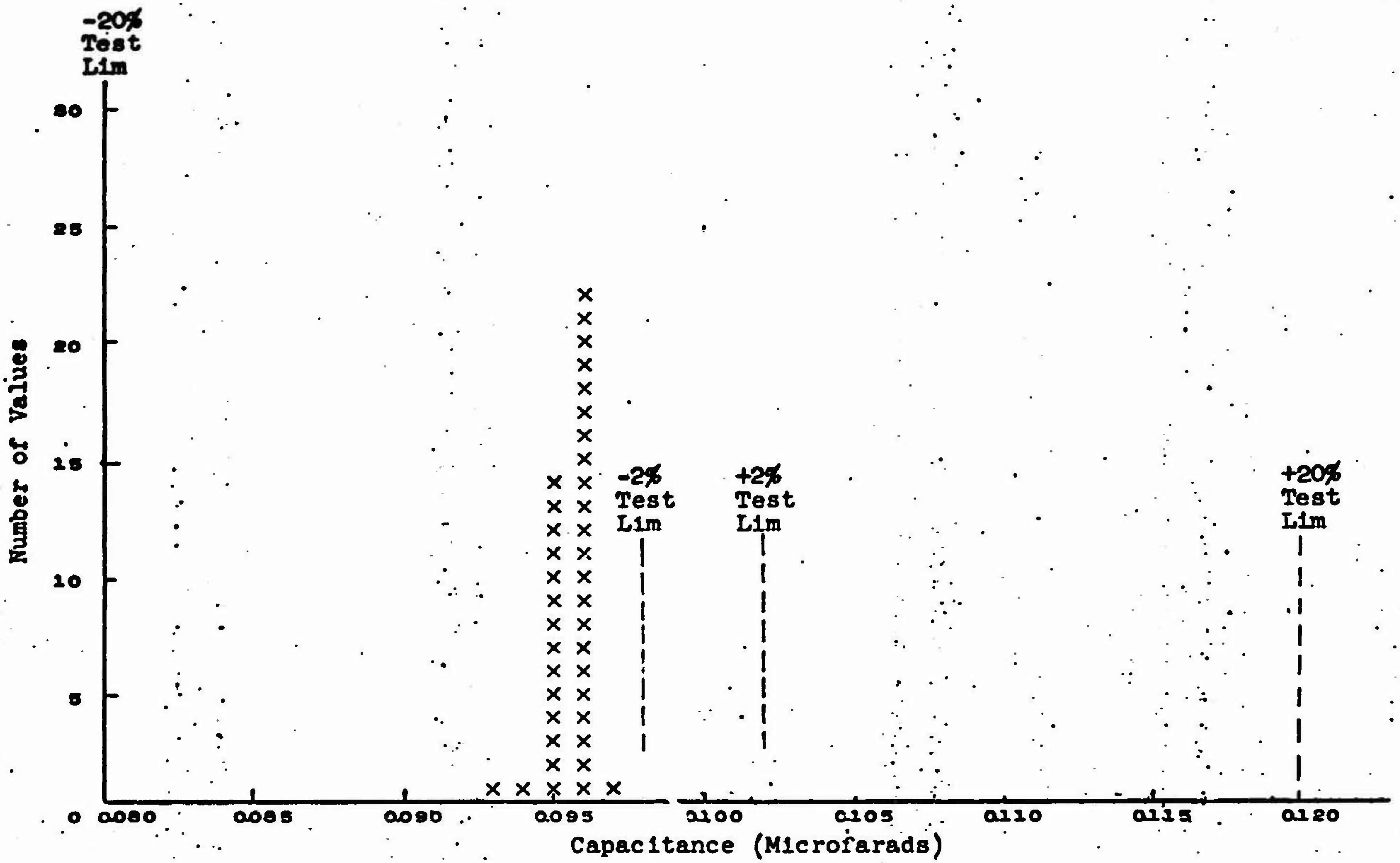


FIGURE 2

DISTRIBUTION OF CAPACITANCE VALUES AT +25° ± 3°C

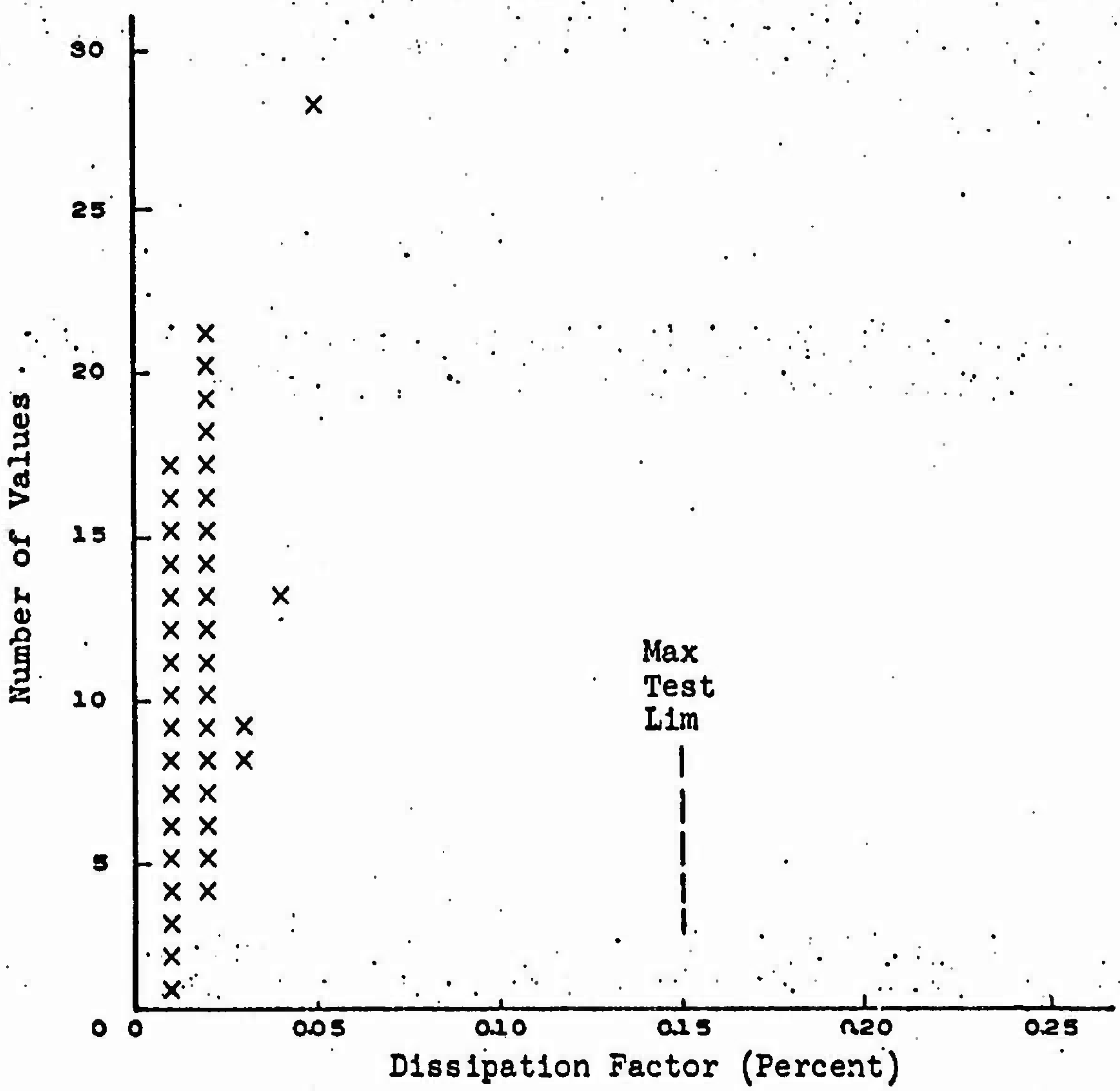


FIGURE 3

DISTRIBUTION OF DISSIPATION-FACTOR
VALUES AT +25° ± 3°C

4.4 Temperature and Life

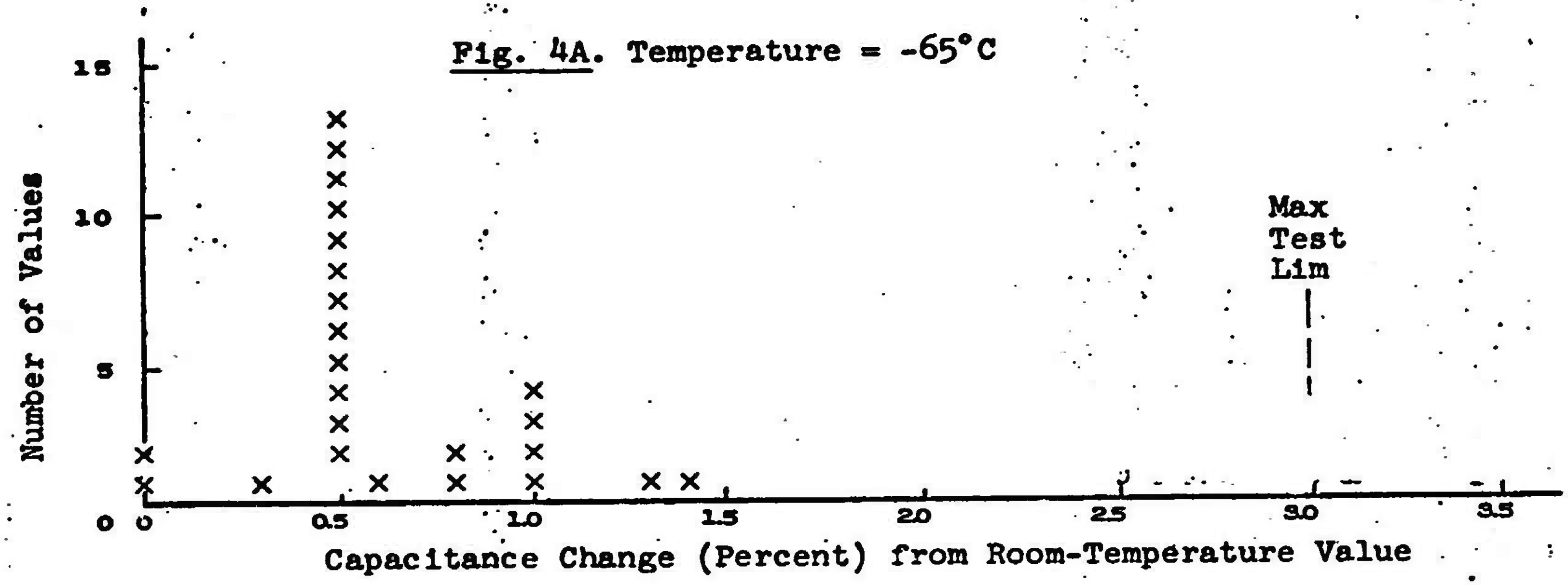
4.4.1 Low Temperature and Capacitance Change with Temperature

No failures were recorded in this test.

The distribution of capacitance-change values at -65° and +125°C is shown in Figure 4. As can be seen, capacitance changes at +125°C were significantly smaller than at the low temperature and were all within 2 percent of the room-temperature reading. These test results correlate favorably with test data submitted by the suppliers.

4.4.2 Temperature Coefficient

Twenty units failed to meet the temperature coefficient limit of 200 ppm/°C over the temperature range of -55° to +125°C. The failure rate was extremely high, indicating that this limit is unrealistic. Distribution plots of temperature coefficient values for test points of -55°C, -15°C, +40°C, +75°C, +100°C, and +125°C are shown in Figure 5. Maximum, median, and minimum values are summarized in Table 6.



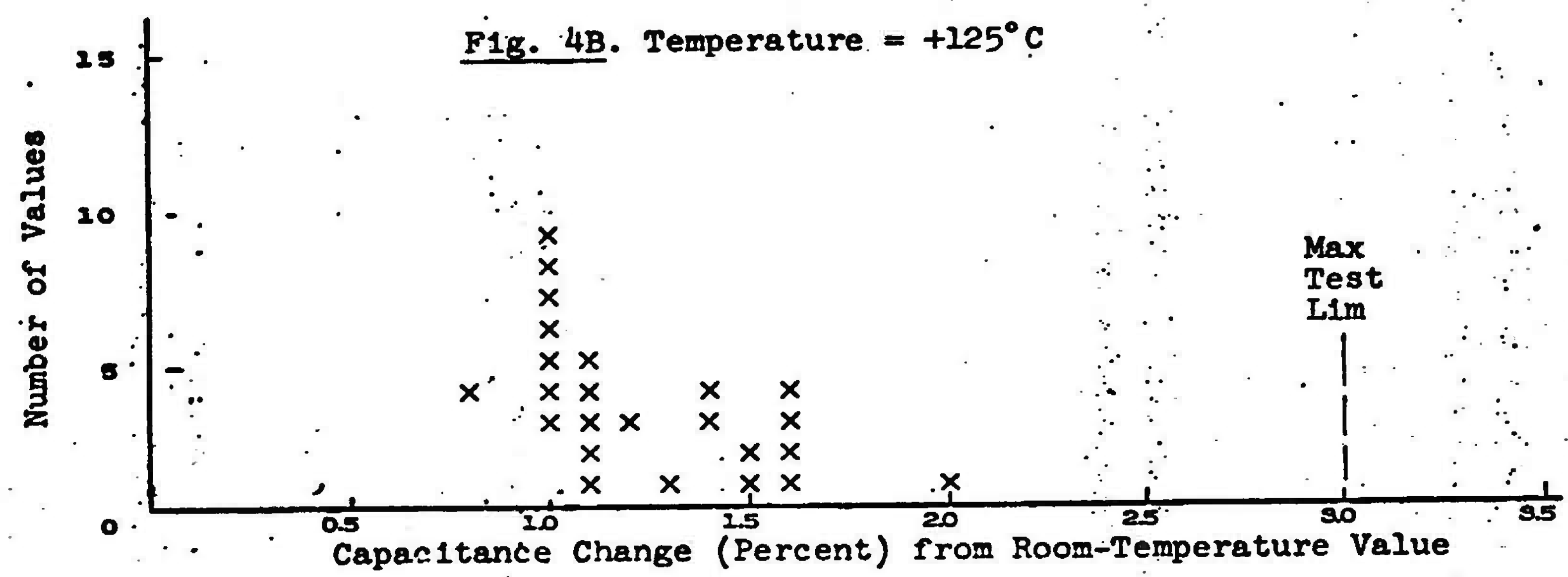


FIGURE 4

DISTRIBUTION OF CAPACITANCE-CHANGE VALUES AT -65°C AND +125°C

TABLE 6

DISTRIBUTION OF TEMPERATURE COEFFICIENT VALUES IN PPM/°C
(TEMPERATURE RANGE: -55° to +125°C)

	-55°C			-15°C			+40°C		
	Min	Med	Max	Min	Med	Max	Min	Med	Max
	-65	-135	-220	-130	-230	-435	0	-70	-480

	-75°C			+100°C			+125°C		
	Min	Med	Max	Min	Med	Max	Min	Med	Max
	-5	-85	-225	-30	-110	-165	65	-105	-185

(1) The temperature coefficients of all test units are significantly lower at the high-temperature extreme (+125°C) than at the low-temperature extreme (-55°C). This is extremely important, since the operation of the circuit assemblies containing these capacitors will likely be at higher temperatures.

(2) The temperature coefficient is not linear or constant over the temperature range (-55°C to +125°C), and is thus not a true indication of capacitor performance. An easier and more clear-cut indication of performance is the change in capacitance over the operating temperature range, as shown in Figure 6. Distribution plots of capacitance change values at six different temperature test points are shown in Figure 7.

Examination of the distribution plots indicates that the maximum expected capacitance change over the temperature range is approximately ±2 percent. As would be expected, this maximum change occurs at the temperature extremes.

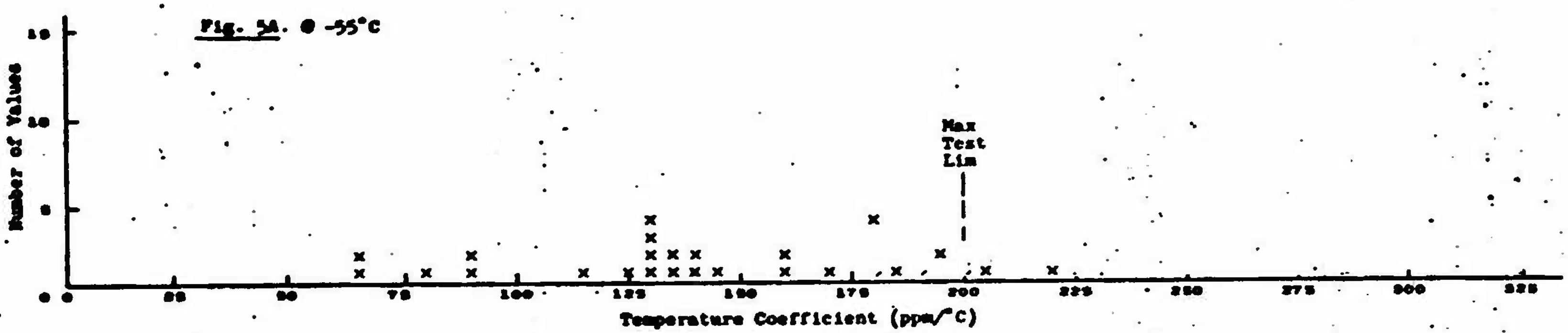
4.4.3 High Temperature Operational Life Test

The sample lot failed the operational life test.

The failure was due to the following:

(1) Two of the capacitors exhibited leakage of impregnant at the conclusion of the test. The apparent cause was a broken hermetic seal in the area of the crimp. The electrical parameters of these two capacitors remained within specification.

(2) One capacitor failed catastrophically (shorted) after 100 hours. Physical examination of the internal assembly indicated that the short was probably due to a break in the dielectric.



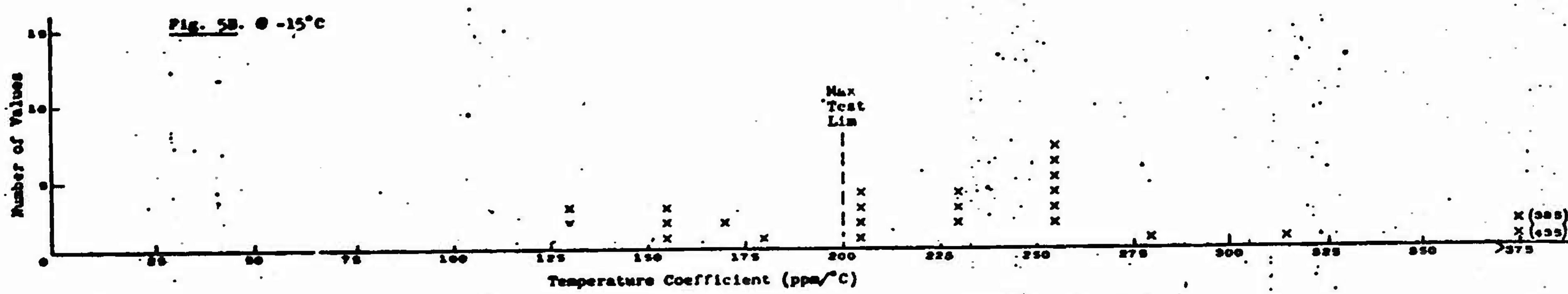


FIGURE 5

DISTRIBUTION OF TEMPERATURE-COEFFICIENT VALUES AT VARIOUS TEMPERATURE LEVELS (SHEET 1 OF 3)

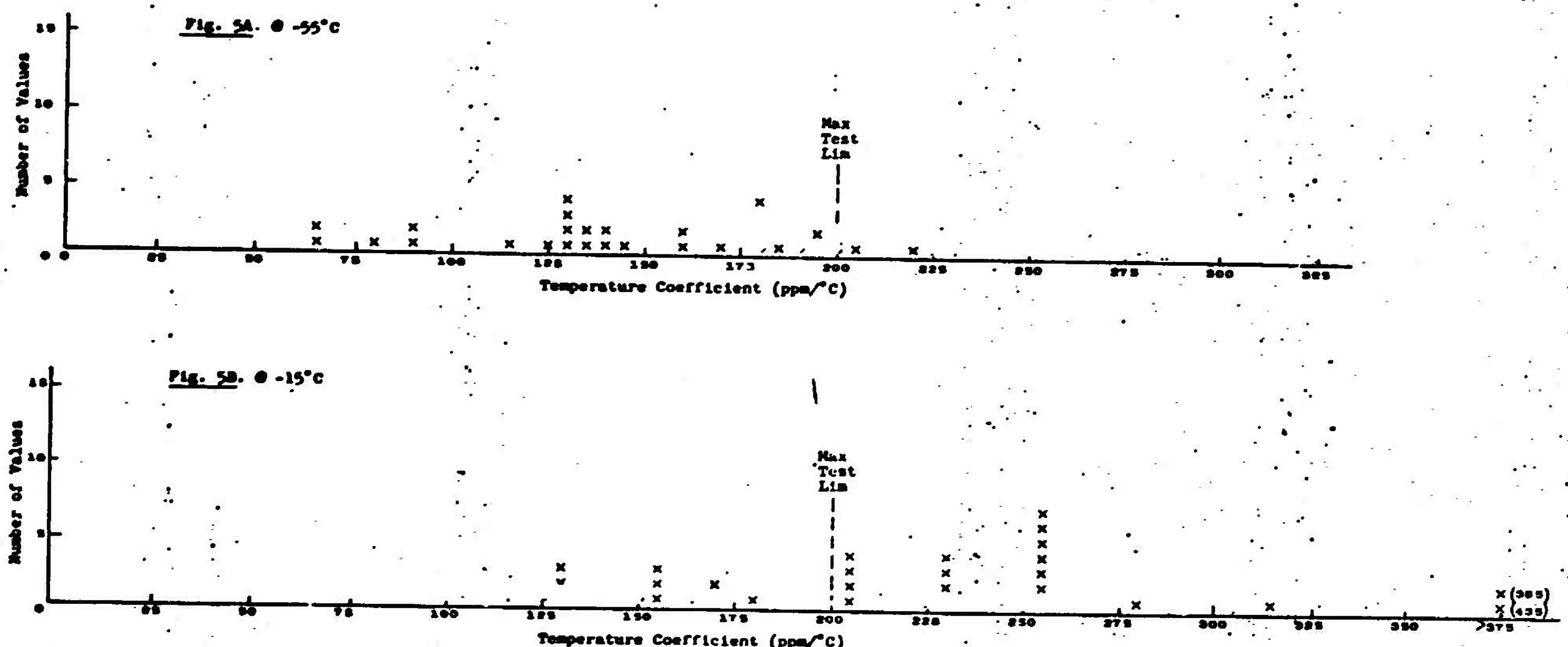


FIGURE 5

DISTRIBUTION OF TEMPERATURE-COEFFICIENT VALUES AT VARIOUS TEMPERATURE LEVELS (SHEET 1 OF 3)

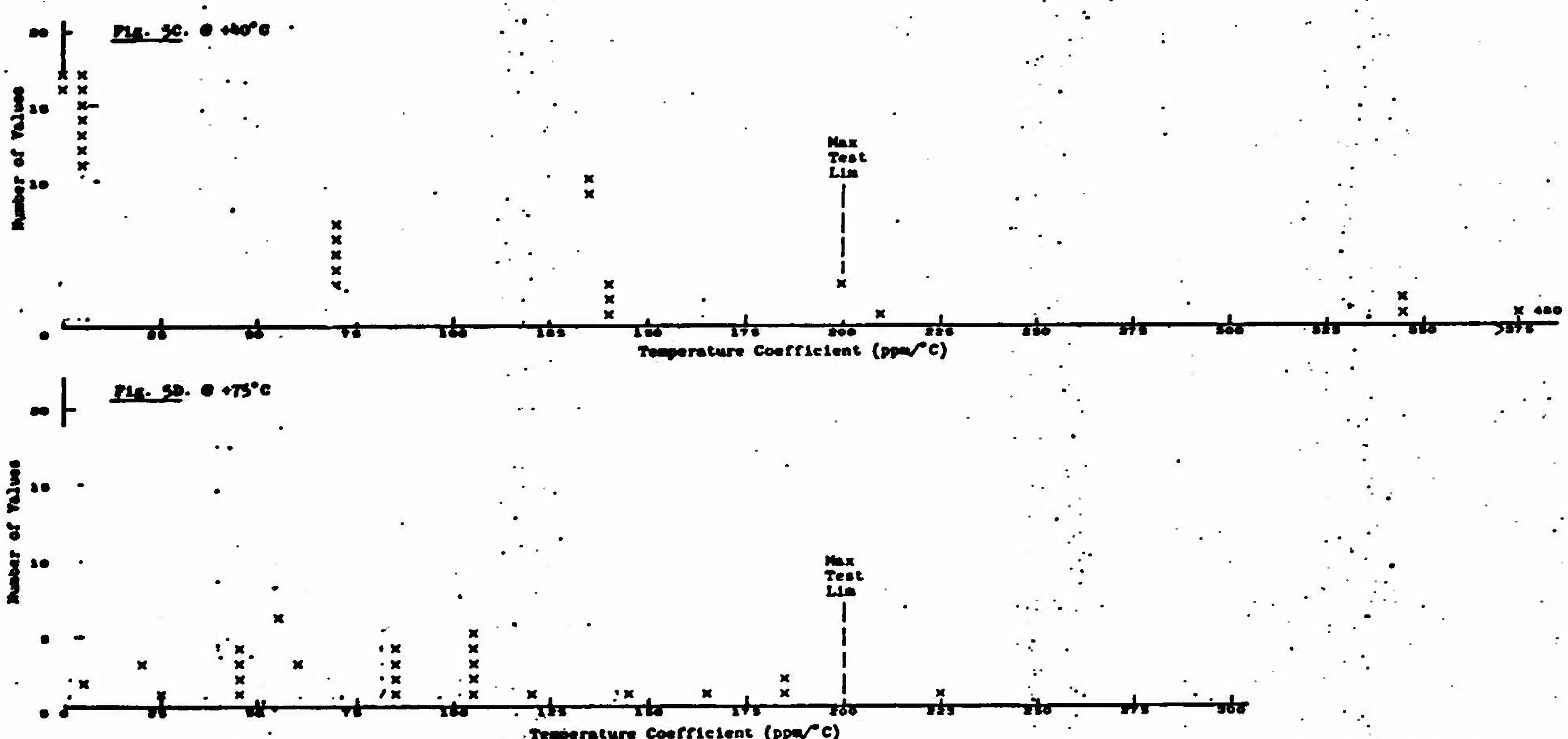


FIGURE 5

DISTRIBUTION OF TEMPERATURE-COEFFICIENT VALUES AT VARIOUS TEMPERATURE LEVELS (SHEET 2 OF 3)

Fig. 5E. @ +100°C

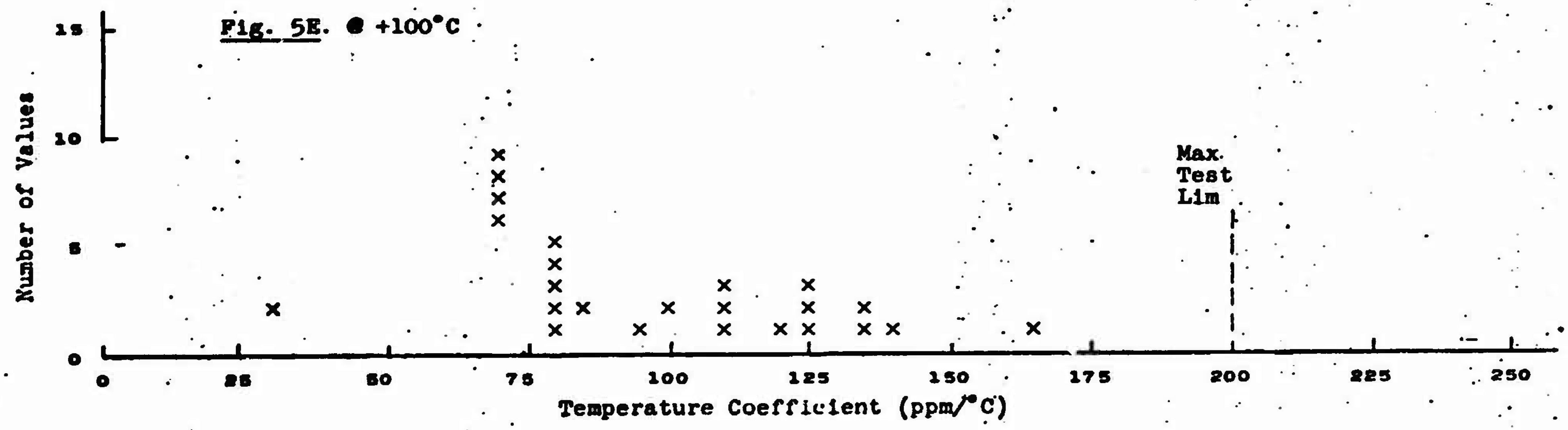


Fig. 5F. @ +125°C

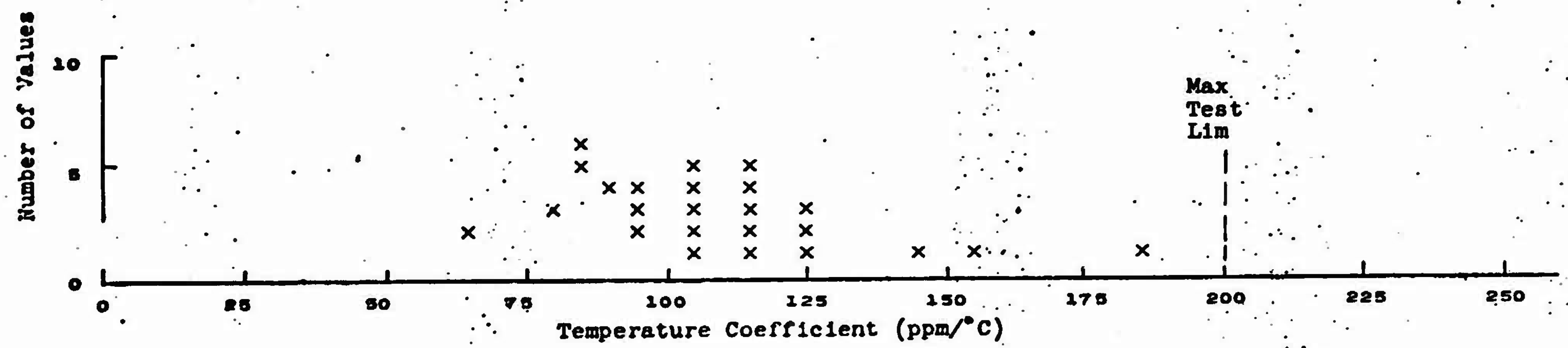


FIGURE 5

DISTRIBUTION OF TEMPERATURE-COEFFICIENT VALUES AT VARIOUS TEMPERATURE LEVELS (SHEET 3 OF 3)

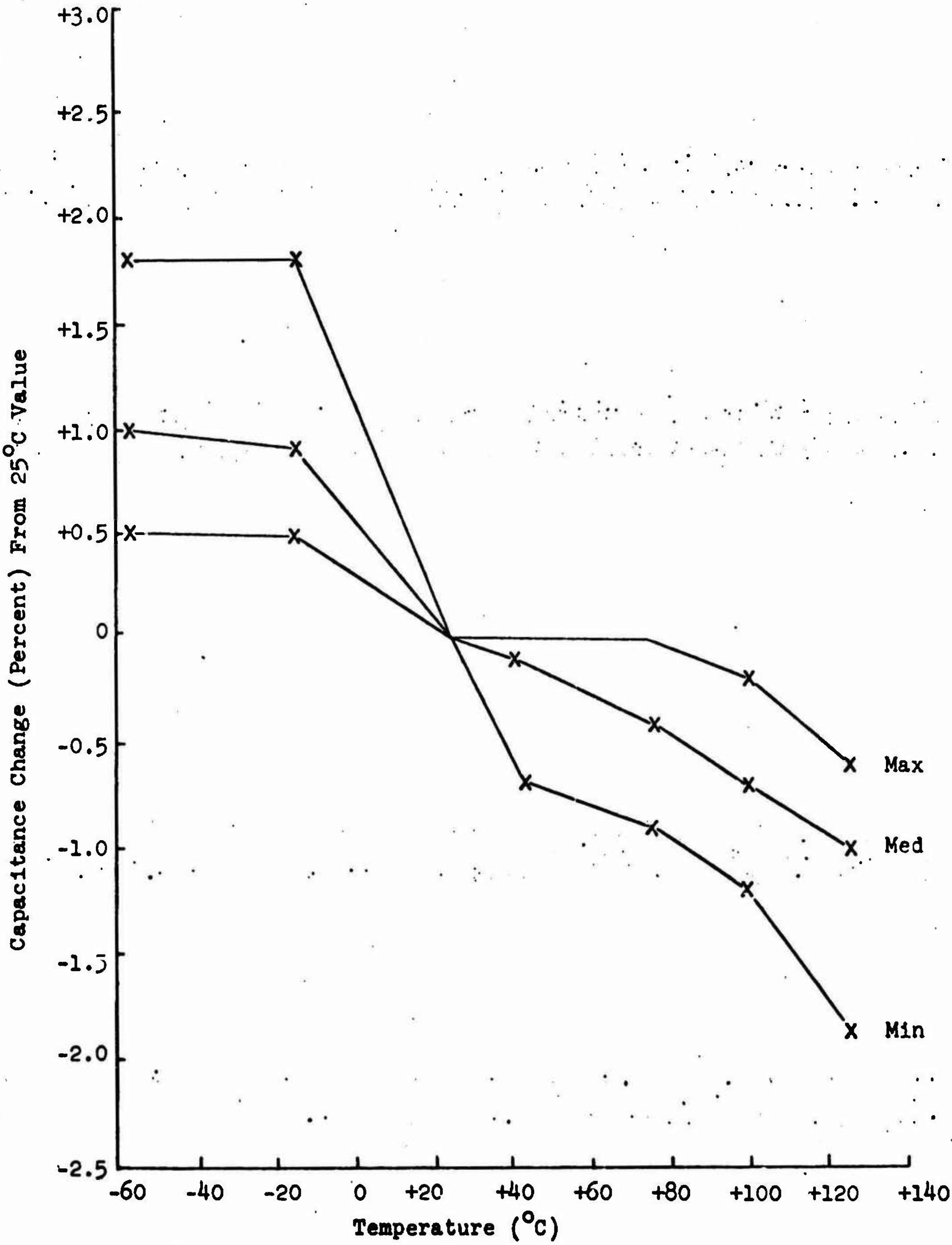
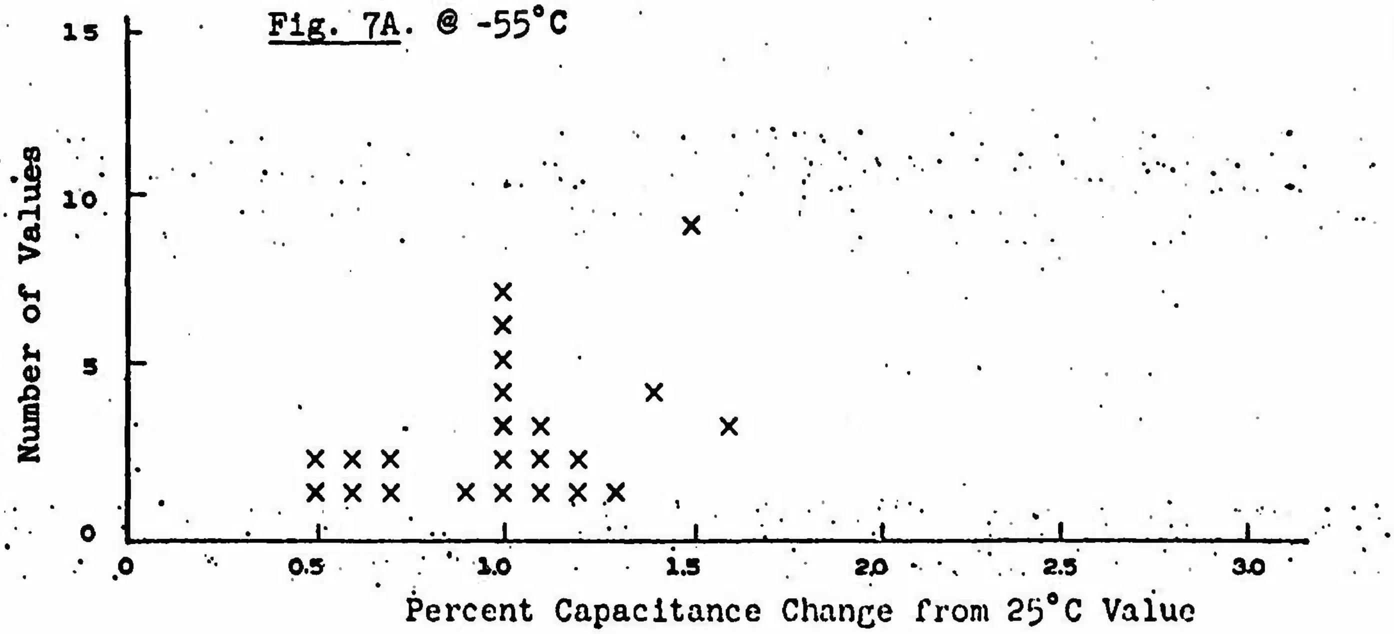


FIGURE 6

Percent Capacitance Change Over Operating Temperature Range (-55° To +125°C)



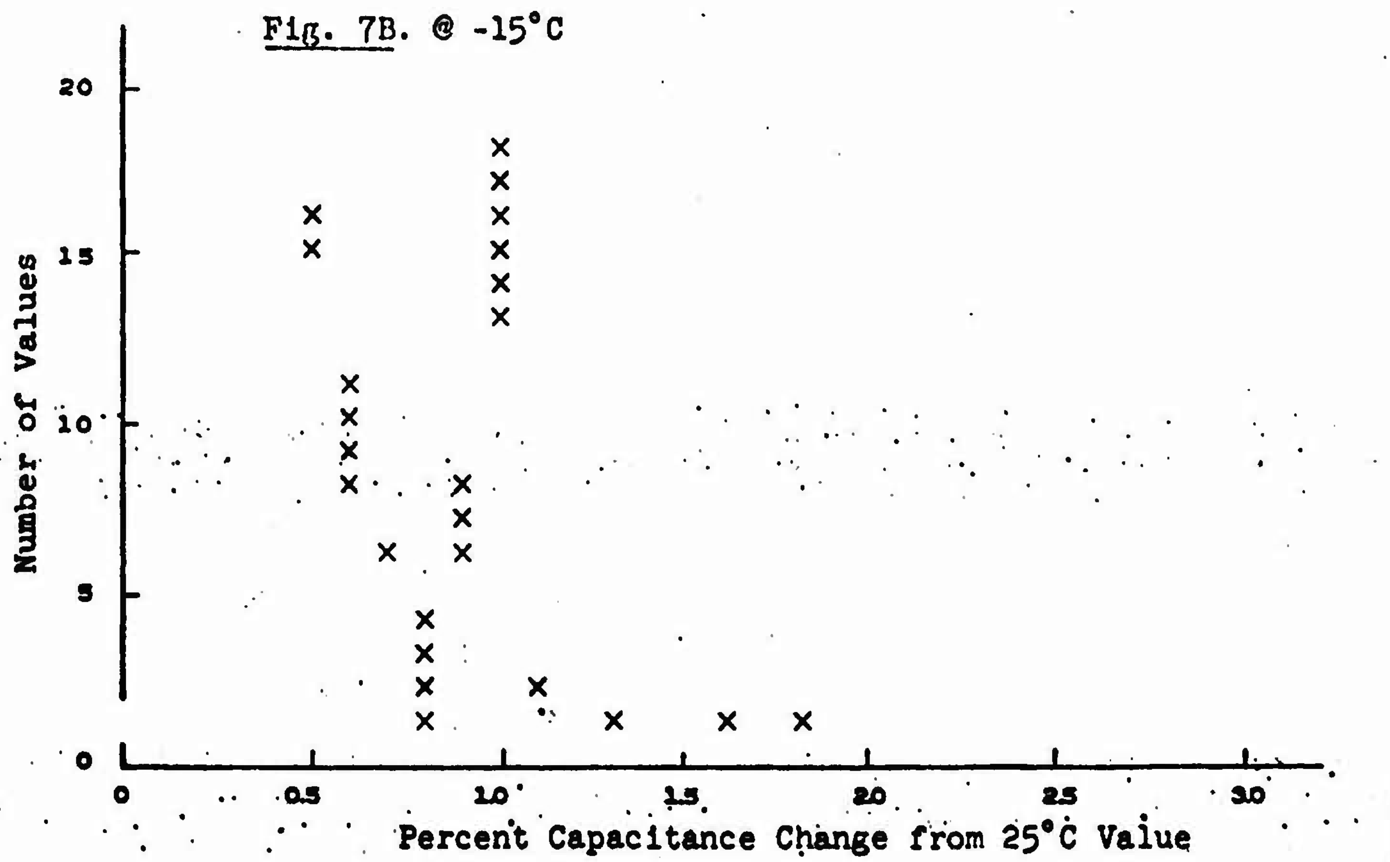


FIGURE 7

DISTRIBUTION OF PERCENT CHANGE IN CAPACITANCE FROM 25°C VALUE (SHEET 1 OF 3)

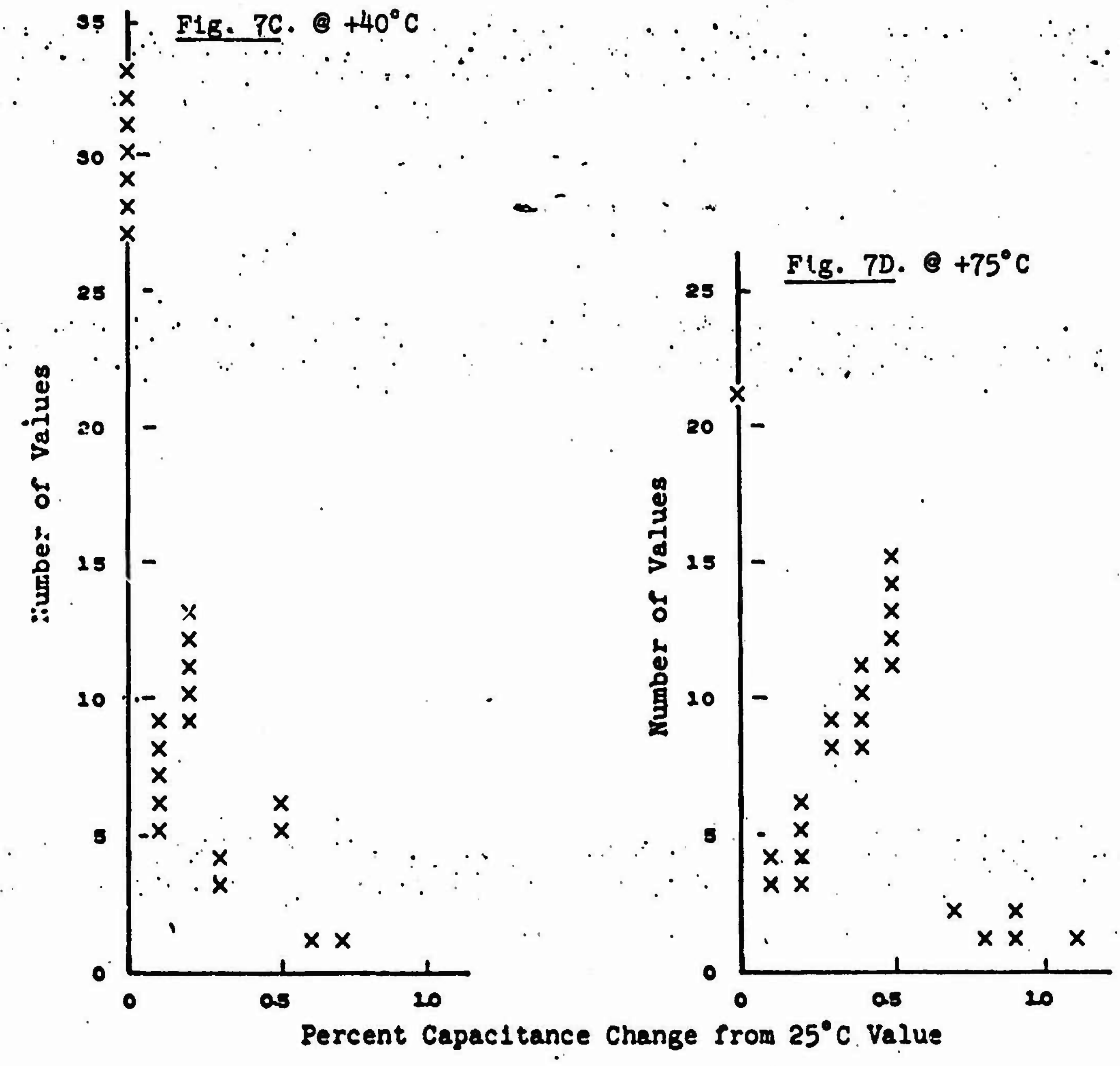
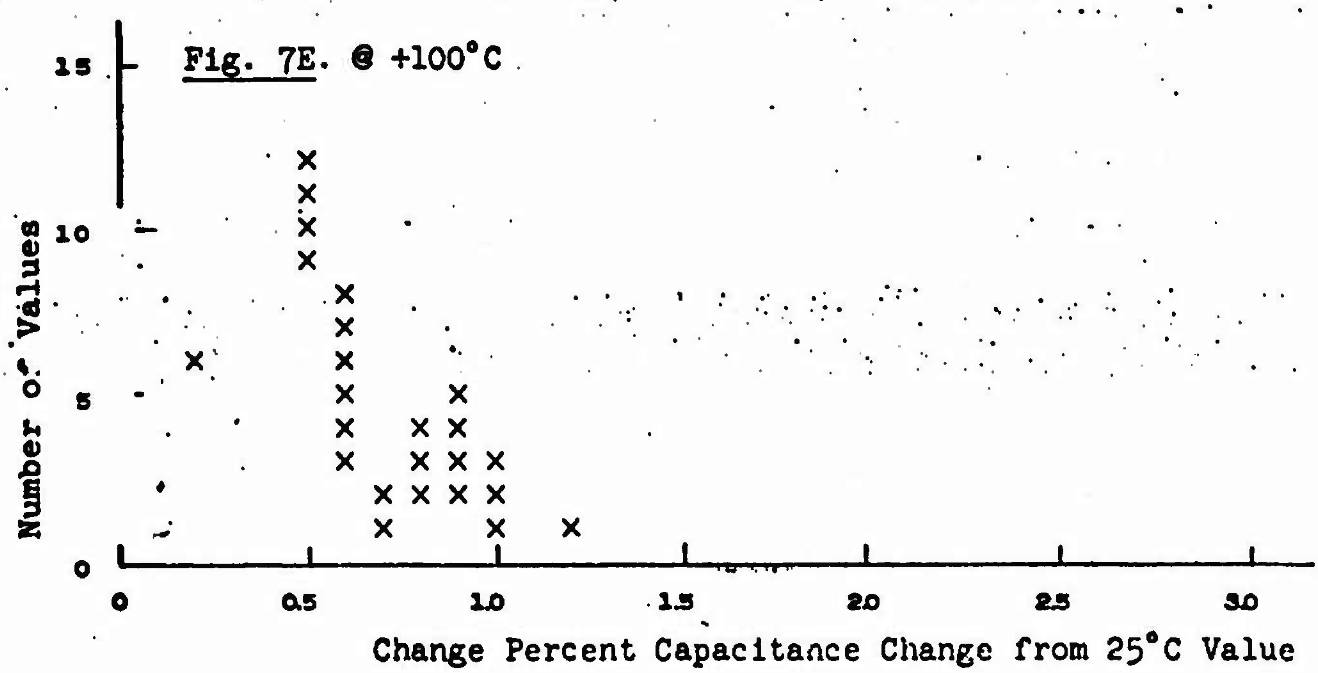


FIGURE 7

DISTRIBUTION OF PERCENT CHANGE IN CAPACITANCE FROM 25°C VALUE (SHEET 2 OF 3)



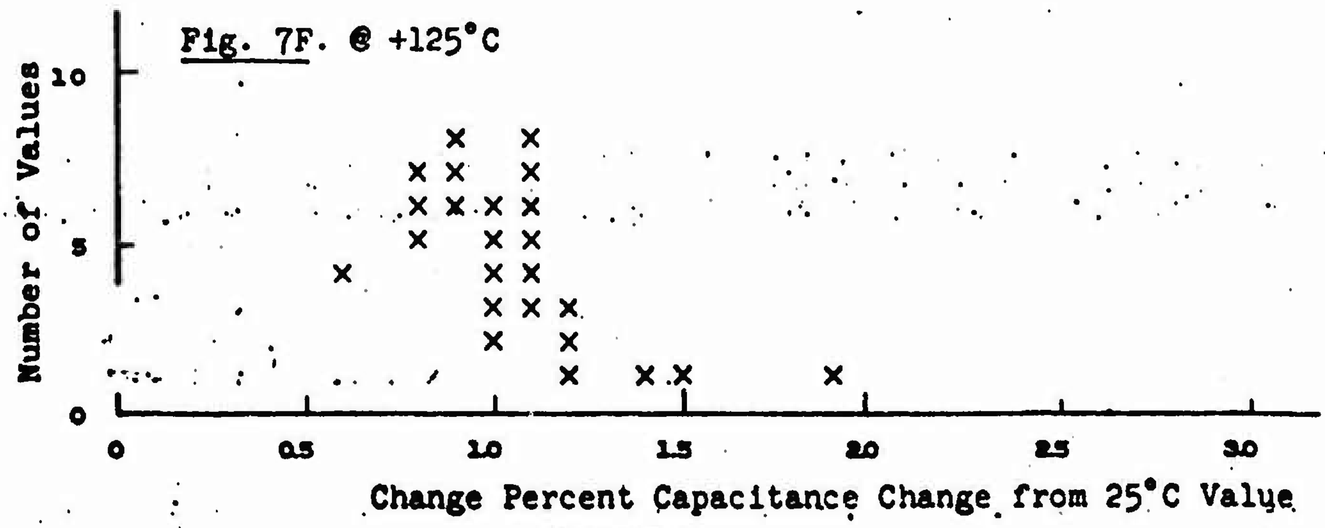


FIGURE 7

DISTRIBUTION OF PERCENT CHANGE IN CAPACITANCE FROM 25°C VALUE
(SHEET 3 OF 3)

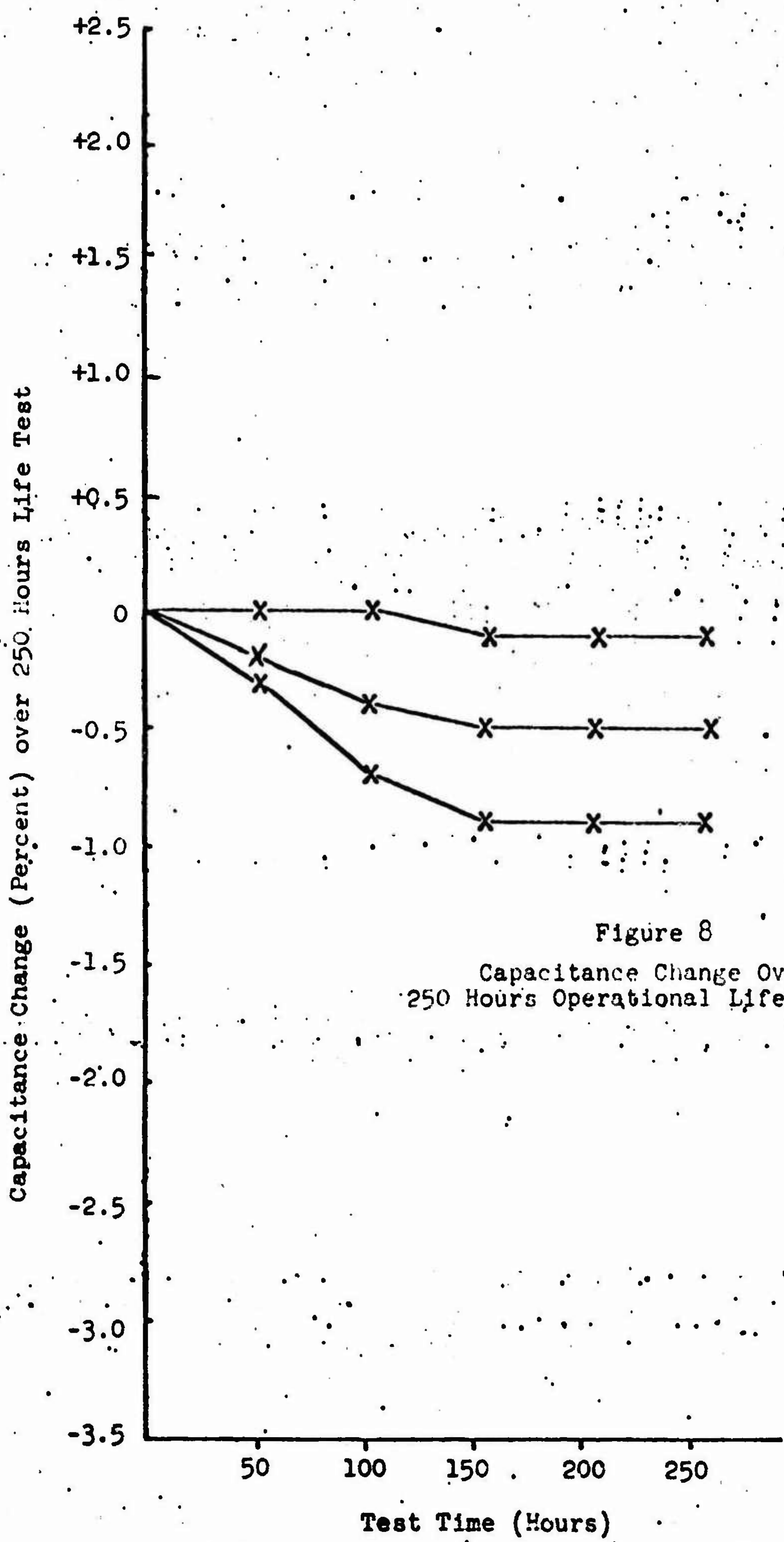
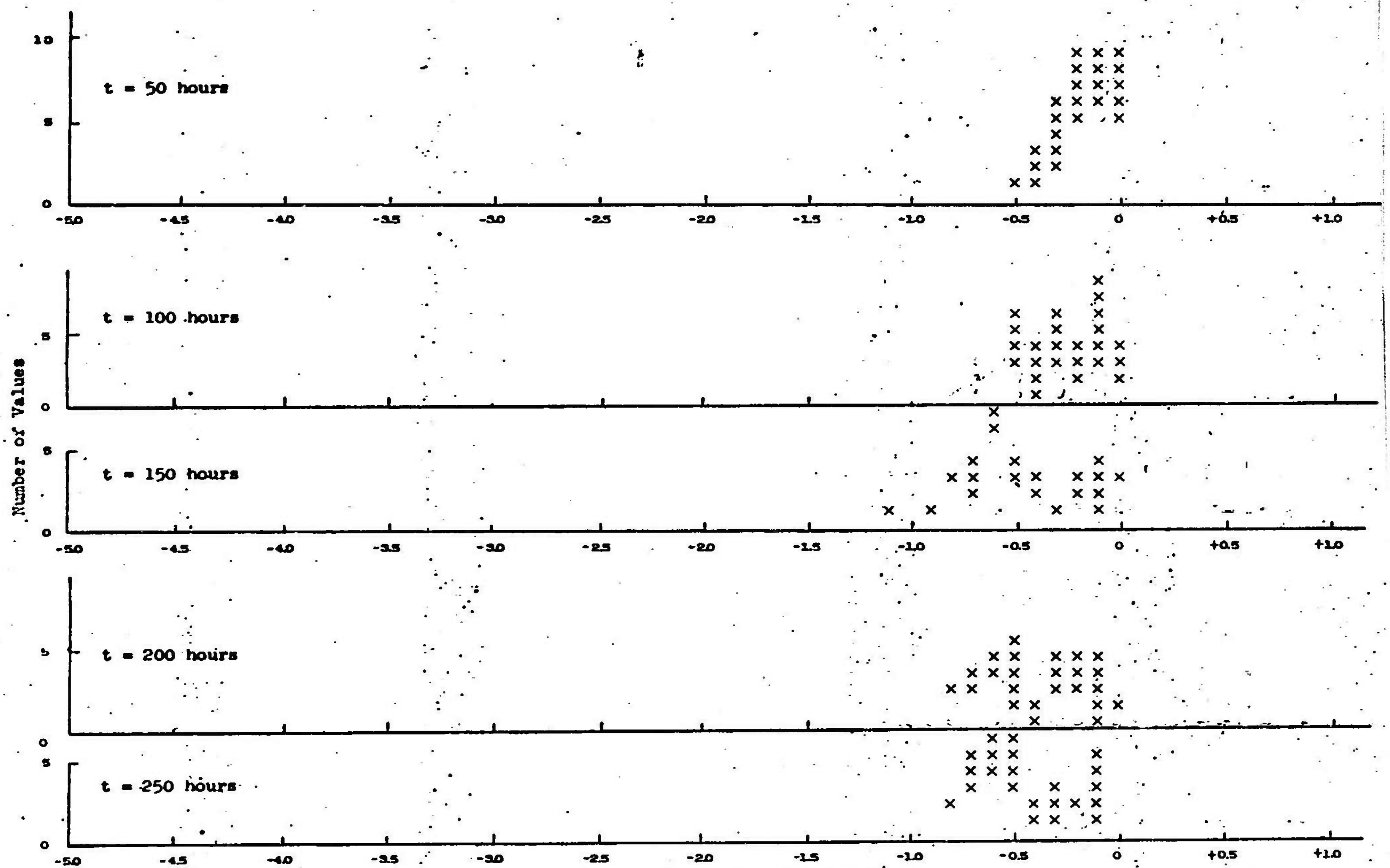


Figure 8

Capacitance Change Over
250 Hours Operational Life Test

40



Percent Capacitance Change from Initial Reading

FIGURE 9

DISTRIBUTION OF PERCENT CHANGE IN CAPACITANCE OVER 250-HOUR OPERATING LIFE TEST

41

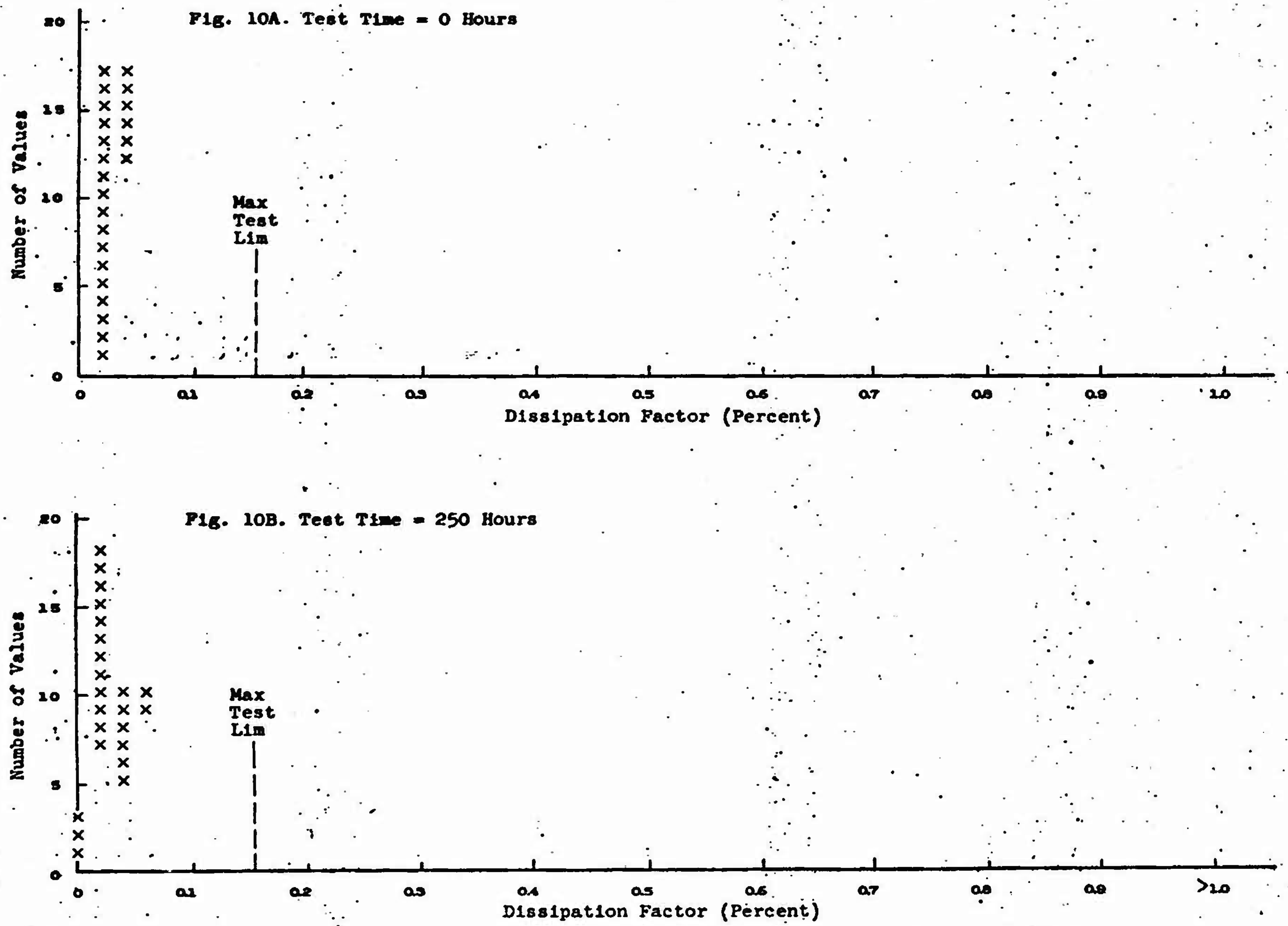


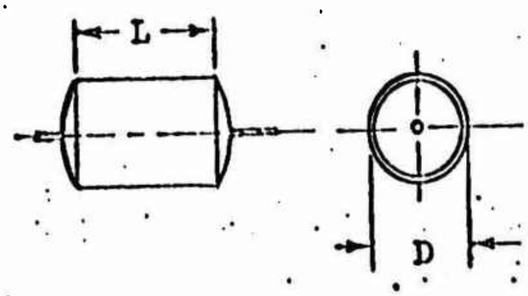
FIGURE 10

DISTRIBUTION OF DISSIPATION-FACTOR VALUES AT BEGINNING AND END OF OPERATING LIFE TEST

42

APPENDIX A

DIMENSIONAL LIMITS FOR METALLIZED POLYCARBONATE CAPACITOR TEST TYPES



Type 483G

L = 0.812 ± 0.062

D = 0.400 ± 0.015

APPENDIX B

RESULTS OF VISUAL AND X-RAY ANALYSES

Capacitor Rating = 0.1 uf ± 20%, 100V

Test S/N	Failure	Discrepancies Noted In X-Ray and Visual Exam	Apparent Failure Mode/Mechanism	Probable Contributing Factors
206	Catastrophic short during life test.	No external visual discrepancies apparent. Internal examination indicated a breakdown of dielectric due to punch-through between layers.	Breakdown of dielectric between layers.	
201	Leakage of impregnant.	Traces of oil on right terminal. Breaks in solder seal near crimped edge.	Inadequate hermetic seal.	Crimping of metal sleeve may have placed undue stress on seal.
212	Leakage of impregnant.	Traces of oil on both terminals. Breaks in solder seal near crimped edge. (See photo B-5.)	Inadequate hermetic seal.	Crimping of metal sleeve may have placed undue stress on seal.

TABLE B-2

RESULTS OF VISUAL AND X-RAY EXAMINATION OF ACCEPTABLE DEVICES

	Capacitor Rating	S/N	Results of Visual and X-Ray Examination
	0.1 uf ±20%, 100V	238	Lacquer film constituting the dielectric was wound in a rather loose and nonuniform fashion. Insulation between the metal housing and the dielectric consisted of an epoxy shell with an oil fill between the shell and the dielectric.
	0.1 uf ±20%, 100V	239	Lacquer film constituting the dielectric was wound in a rather loose and nonuniform fashion. Insulation between the metal housing and the dielectric consisted of an epoxy shell with an oil fill between the shell and the dielectric.

APPENDIX C

AMERICAN LABORATORIES REPORT 387225
Report of Environmental Tests Performed on
Capacitors, Polycarbonate, for
ARINC Research Corporation.

AMERICAN LABORATORIES
OPERATING DIVISION of
AMERICAN ELECTRONICS, INC.
SERVICEMARK
RELIABILITY THROUGH TESTING
1536 East Valencia Drive • Fullerton, California
TRojan 1-3020

AMERICAN LABORATORIES REPORT NUMBER 387225
REPORT OF ENVIRONMENTAL TESTS
PERFORMED ON
CAPACITORS, POLYCARBONATE
FOR
ARINC RESEARCH CORPORATION

American Laboratories
1536 East Valencia Drive
Fullerton, California

October 1966

48

NOTICES

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

ADMINISTRATIVE DATA

DATE: October 26, 1966

1. PURPOSE OF TEST: To perform Environmental Tests to determine compliance with the specifications cited below.

2. MANUFACTURER: Thompson-Ramo Woolridge, Type 10401W2

3. MANUFACTURER'S PART NO. 10401W2

4. SERVICE FOR: ARINC Research Corporation
   1222 East Normandy Place
   Santa Ana, California

5. DESCRIPTION OF SAMPLE: Capacitors, Polycarbonate

6. REFERENCES: (1) ARINC ETP No. 66-126
   (2) MIL-STD-202C, Test methods for electronic and electrical component parts

7. QUANTITY OF ITEMS TESTED: Thirty-six (36) samples were tested

Serial No.	Sample No.
None	225-236

8. SECURITY CLASSIFICATION: Unclassified

9. DATE TESTS COMPLETED: October 25, 1966

10. TESTS CONDUCTED BY: American Laboratories

11. DISPOSITION OF SPECIMENS: Returned to ARINC Research Corporation

12. ABSTRACT:

Test No.	Page No.	Test	Samples	Results
1	1.0-1.3	Barometric Pressure	225-236	Pass
2	2.0-2.3	Shock (medium impact)	231-236	Pass
3	3.0-3.3	Vibration	231-236	Pass

Continued on next page

ADMINISTRATIVE DATA (CONTINUED)

12. ABSTRACT (CONTINUED)

TEST NO.	PAGE NO.	TEST	SAMPLES	RESULTS
4	4.0-4.3	SALT SPRAY	231-236	PASS
5	5.0-5.3	MOISTURE RESISTANCE	225-230	PASS
	1 - 4	APPENDIX 1 (EQUIPMENT LIST)		

13. STANDARD TEST CONDITIONS: ROOM AMBIENT, UNLESS OTHERWISE NOTED IN RESULTS.

14. SOURCE INSPECTION: NONE

1. BAROMETRIC PRESSURE

Samples 225-236, Capacitors

REFERENCES: (1) ARINC Research Corporation ETP-66-126
(2) MIL-STD-202C, Test methods for electronic and electrical component parts

REQUIREMENTS:

Ref. 1 - Paragraph (2) is applicable

Ref. 2 - Method 105 is applicable

FACTUAL DATA

A. EQUIPMENT:

See Appendix I

52

1. BAROMETRIC PRESSURE

Samples 225-236, CAPACITORS

B. TEST PROCEDURE:

1. MOUNT THE SAMPLES TO A SUITABLE FIXTURE AND PLACE THEM IN AN ALTITUDE CHAMBER.
2. REDUCE THE PRESSURE OF THE CHAMBER TO 0.82 INCHES OF MERCURY AND APPLY THE FOLLOWING VOLTAGES TO THE SAMPLES FROM EACH TERMINAL TO CASE FOR A PERIOD OF 1 MINUTE MINIMUM:

   225-236 - 200VDC

   OBSERVE THE SAMPLES FOR ANY ARCING, MOMENTARY OR INTERMITTENT, OR OTHER INDICATION OF BREAKDOWN.
3. VISUALLY EXAMINE THE SAMPLES FOR ANY EVIDENCE OF PHYSICAL DAMAGE.
4. RECORD ALL DATA.

10-10-66	CAPACITORS, POLYCARBONATE	W. WALTI
TEMP: AMBIENT	TEST: 17) BAROMETRIC PRESSURE	
HUMIDITY: AMBIENT	VENDOR: [illegible] RESEARCH CORP.	
	CHAMBER PRESSURE: 0.82 IN. OF MERCURY	

SAMPLE NUMBER	200 VDC AT PRESSURE	PHYSICAL DAMAGE
225	PASS	NONE
226		
227		
228		
229		
230		
231		
232		
233		
234		
235		
236	PASS	NONE

VISUAL EXAMINATION FOLLOWING BAROMETRIC PRESSURE

THERE WAS NO EVIDENCE OF VISIBLE PHYSICAL DAMAGE AS A RESULT OF THE BAROMETRIC PRESSURE TEST.

DATE STARTED: 10/10/66	PARTS TEST DATA	TEST ENGINEER: D.F. SMEAL
DATE COMPLETED: 10/10/66	SPECIMEN DESCRIPTION: CAPACITORS, POLYCARBONATE	GROUP LEADER: W WALTI
TEMP: —	TEST: 1.) BAROMETRIC PRESSURE	
HUMIDITY: —	VENDOR: ARINC RESEARCH CORP.	

CONCLUSION:

SINCE THERE WAS NO EVIDENCE OF VISIBLE DAMAGE AND SINCE ALL OF THE ELECTRICAL MEASUREMENTS MADE WERE WITHIN THE SPECIFIED LIMITS, THE SAMPLES MET THE REQUIREMENTS OF THE BAROMETRIC PRESSURE TEST.

RECOMMENDATIONS:

NONE. DATA MERELY SUBMITTED

2. SHOCK

Samples 231-236, CAPACITORS

REFERENCES: (1) ARINC RESEARCH CORPORATION ETP-66-126
(2) MIL-STD-202C, TEST METHODS FOR ELECTRONIC AND ELECTRICAL COMPONENT PARTS

REQUIREMENTS:

REF. 1 - PARAGRAPH 3A IS APPLICABLE

REF. 2 - METHOD 205, CONDITION C IS APPLICABLE

FACTUAL DATA

A. EQUIPMENT:

SEE APPENDIX 1

2. SHOCK

Samples 231-236, CAPACITORS

B. TEST PROCEDURE:

1. MOUNT THE SAMPLES ON A FIXTURE WITH THE SAMPLE BODIES RIGIDLY MOUNTED TO THE FIXTURE AND THE FIXTURE MOUNTED ON THE MEDIUM IMPACT SAND DROP TOWER.

2. SUBJECT THE SAMPLES TO THREE SHOCKS IN EACH DIRECTION OF THE THREE MUTUALLY PERPENDICULAR AXIS FOR A TOTAL OF 18 SHOCKS. THE SHOCK INTENSITY AND DURATION SHALL BE 50G 11 MS. DURING THE SHOCKS MONITOR THE SAMPLES FOR ANY ELECTRICAL FAILURES, WITH 250VDC APPLIED BETWEEN THE TERMINALS OF SAMPLES 31-36 AND 125VDC APPLIED BETWEEN THE TERMINALS OF SAMPLES 131-136 AND 231-236.

3. THERE SHALL BE NO ELECTRICAL FAILURES AND NO PHYSICAL DAMAGE DURING OR FOLLOWING THE TEST.

4. RECORD ALL DATA.

DATE STARTED: 10-14-66	PARTS TEST DATA	TEST ENGINEER: A. F. Smeck
DATE COMPLETED: 10-14-66	SPECIMEN DESCRIPTION: CAPACITOR	GROUP LEADER: W. WALTI
TEMPERATURE: AMBIENT	TEST: SHOCK 2.)	SPECIFICATION LIMITS:
HUMIDITY: AMBIENT	VENDOR: ARINC	

TIME	G	H	D	AXIS	NO. SHOCKS	SAMPLE	COMMENT
							SPECIFIED
11 MILSEC	50	30"	SAND	X	3	231-236	UNIT
				X'	3		
				Y	3		NO ELECTRICAL FAILURES
				Y'	3		OR PHYSICAL DAMAGE
				Z	3		
11 MILSEC	50	30"	SAND	Z'	3	231-236	

VISUAL EXAMINATION FOLLOWING SHOCK:

THERE WAS NO EVIDENCE OF VISIBLE PHYSICAL DAMAGE AS A RESULT OF THE SHOCK TEST. THERE WAS NO EVIDENCE OF INTERMITTENT SHORTING OR OPEN CIRCUITS WITH 250 VDC APPLIED ACROSS THE SAMPLES.

DATE STARTED: 10/14/66	PARTS TEST DATA	TEST ENGINEER: D. E. SMEAL
DATE COMPLETED: 10/14/66	SPECIMEN DESCRIPTION: CAPACITORS, POLYCARBONATE	GROUP LEADER: W WALTI
TEMP: —	TEST: 2.) SHOCK	
HUMIDITY: —	VENDOR: ARINC RESEARCH CORP.	

CONCLUSION:

SINCE THERE WAS NO EVIDENCE OF PHYSICAL DAMAGE OR ELECTRICAL FAILURE, THE SAMPLES MET THE REQUIREMENTS OF THE SHOCK TEST.

RECOMMENDATIONS:

NONE. DATA MERELY SUBMITTED.

3. VIBRATION

Samples 231-236, CAPACITORS

REFERENCES: (1) ARINC RESEARCH CORPORATION ETP-66-126
(2) MIL-STD-202C, TEST METHODS FOR ELECTRONIC AND ELECTRICAL COMPONENT PARTS

REQUIREMENTS:

REF. 1 - PARAGRAPH 3B IS APPLICABLE

REF. 2 - METHOD 204, TEST CONDITION B IS APPLICABLE

FACTUAL DATA

A. EQUIPMENT:

SEE APPENDIX I

3. VIBRATION

Samples 231-236, CAPACITORS

B. TEST PROCEDURE:

1. MOUNT THE SAMPLE BODIES RIGIDLY TO A VIBRATION FIXTURE WITH THE LEADS SECURED 1/2 ± 1/8 INCH FROM THE CASE. MOUNT THE FIXTURE TO THE VIBRATION MACHINE AND VIBRATE IN ACCORDANCE WITH THE FOLLOWING CONDITIONS:

   A. VIBRATION FREQUENCY-10-2000
   B. VIBRATION LEVEL-0.06" OR 15G, WHICHEVER IS LESS
   C. DIRECTION-TWO MUTUALLY PERPENDICULAR AXIS-ONE PARALLEL AND ONE PERPENDICULAR TO THE CYLINDRICAL AXIS OF THE SAMPLES.
   D. VIBRATION TIME- 4 HOURS IN EACH DIRECTION OF STEP C.

   E. SWEEP TIME-10-2000-10 IN 20 MINUTES.

2. DURING THE LAST CYCLE OF VIBRATION IN EACH DIRECTION, MONITOR THE SAMPLES FOR OPENINGS OF MORE THAN 0.5 MILLISECONDS AND SHORT CIRCUITS OF THE SAMPLES.

3. FOLLOWING THE VIBRATION TEST, EXAMINE THE SAMPLES FOR ANY EVIDENCE OF PHYSICAL DAMAGE.

4. RECORD ALL DATA.

DATE STARTED: 10-17-66	PARTS TEST DATA		TEST ENGINEER: G. SIMMONS
DATE COMPLETED: 10-17-66	SPECIMEN DESCRIPTION: CAPACITOR, POLYCARBONATE	TEST: 3.) VIBRATION	HUMIDITY: ROOM
TEMP: AMBIENT	VENDOR: ARINC		

DATE	TIME	TA	VIBRATION FREQ.	DOUBLE AMPLITUDE	INPUT ACCEL.	SAMPLE No.	AXIS						COMMENT
1966	—	°F	CPS	INCH	G, PEAK								SPECIFIED
10-17	0700	82	10-70	0.060	—		X						BEGAN CYCLE-1
			70-2K	—	15.0								
			2K-70	—	15.0								
	0720		70-10	0.060	—								END CYCLE-1
			—	—	—								REPEAT CYCLE-1
			—	—	—								FOR A TOTAL OF
			—	—	—								12 CYCLES (4 HRS)
	1100		—	—	—		X						END CYCLE-12
10-17	1300	82	10-70	0.060	—		Y						BEGAN CYCLE-1
			70-2K	—	15.0								
			2K-70	—	15.0								
	1320		70-10	0.060	—								END CYCLE-1
			—	—	—								REPEAT CYCLE-1
			—	—	—								FOR A TOTAL OF
			—	—	—								12 CYCLES (4 HRS)
	1700		—	—	—	231-236	Y						END CYCLE-12
	NOTE:	THERE WAS	NO EVIDENCE OF OPEN		OR	SHORT CIRCUITS	IN EXCESS OF						0.5 MILLISECONDS.

DATE STARTED: 10/17/66	PARTS TEST DATA	TEST ENGINEER: L. F. SMEHL
DATE COMPLETED: 10/17/66	SPECIMEN DESCRIPTION: CAPACITORS, POLYCARBONATE	GROUP LEADER: W. WALTI
TEMP: —	TEST: 3.) VIBRATION	
HUMIDITY: —	VENDOR: ARINC RESEARCH CORP.	

VISUAL EXAMINATION FOLLOWING VIBRATION:

THERE WAS NO EVIDENCE OF VISIBLE PHYSICAL DAMAGE AS A RESULT OF THE VIBRATION TEST.

CONCLUSION:

SINCE THERE WAS NO EVIDENCE OF PHYSICAL DAMAGE OR ELECTRICAL DEGRADATION DURING THE VIBRATION TEST, THE SAMPLES MET THE REQUIREMENTS OF THE VIBRATION TEST.

RECOMMENDATIONS:

NONE. DATA MERELY RECORDED.

4. SALT SPRAY

Samples 231-236, CAPACITORS

B. TEST PROCEDURE:

1. SUBJECT THE SAMPLES TO 48 HOURS OF SALT SPRAY (20% SOLUTION) PER METHOD 101 OF REFERENCE 2.

2. UPON REMOVAL FROM THE SALT SPRAY CHAMBER WASH THE SAMPLES IN RUNNING TAP WATER, NOT WARMER THAN 100°F, BRUSHING LIGHTLY WITH A SOFT HAIR OR PLASTIC BRISTLE BRUSH.

3. VISUALLY EXAMINE THE SAMPLES FOR ANY EVIDENCE OF HARMFUL CORROSION, UNWRAPPING OF, OR MECHANICAL DAMAGE TO THE INSULATING SLEEVES AND OBLITERATION OF MARKINGS.

4. RECORD ALL DATA.

DATE STARTED: 10-19-66	PARTS TEST DATA	TEST ENGINEER: K. Hamilton
DATE COMPLETED: 10-21-66	SPECIMEN DESCRIPTION: CAPACITORS, POLYCARBONATE	GROUP LEADER: G. SIMMONS
TEMP: 95°F	TEST 4.) SALT SPRAY	
HUMIDITY: 85%	VENDOR: ARINC RESEARCH CORP.	
C. TEST RESULTS:	EXPOSURE TABLE	

DATE	TIME	T_A	P_N	FOG	A	D_F	pH	SAMPLE	COMMENT
1966	—	95±5°F	12-18	18-22	0.5-3.0	1.126-1.157	6.5-7.2	NOTED	SPECIFIED
10-19	1450	93	17	20	—	1.135	6.8	231-236	BEGAN EXPOSURE
10-20	1000	97	17	20	1.85	1.135	6.8	↓	CHECK CHAMBER
10-21	1450	97	17	20	1.85	1.135	6.8	231-236	END OF EXPOSURE

VISUAL EXAMINATION FOLLOWING SALT SPRAY EXPOSURE

THERE WAS NOT ANY EVIDENCE OF PHYSICAL DAMAGE, CORROSION OR DETERIORATION.

65

DATE STARTED: 10/19/66	PARTS TEST DATA	TEST ENGINEER: D. F. SMEAL
DATE COMPLETED: 10/21/66	SPECIMEN DESCRIPTION: CAPACITORS, POLYCARBONATE	GROUP LEADER: W WALTI
TEMP: —	TEST: 4.) SALT SPRAY	
HUMIDITY: —	VENDOR: ARINC RESEARCH CORP.	

CONCLUSION:

SINCE THERE WAS NO EVIDENCE OF EXCESSIVE PHYSICAL DAMAGE OR DETERIORATION, THE SAMPLES MET THE REQUIREMENTS OF THE SALT SPRAY TEST.

RECOMMENDATIONS:

NONE. DATA MERELY SUBMITTED.

5. MOISTURE RESISTANCE

Samples 225-230, CAPACITORS

REFERENCES: (1) ARINC RESEARCH CORPORATION ETP-66-126
(2) MIL-STD-202C, TEST METHODS FOR ELECTRONIC AND ELECTRICAL COMPONENT PARTS

REQUIREMENTS:

REF. 1 - PARAGRAPH 3C IS APPLICABLE

REF. 2 - METHOD 106B IS APPLICABLE

FACTUAL DATA

A. EQUIPMENT:

SEE APPENDIX 1

67

5. MOISTURE RESISTANCE

Samples 225-230, CAPACITORS

B. TEST PROCEDURE:

1. MOUNT THE SAMPLES ON A NON-CORROSIVE FIXTURE AND PLACE THEM IN A CHAMBER PROGRAMMED FOR METHOD 106B OF REFERENCE 2. THE FOLLOWING CONDITIONS SHALL APPLY:

   A. PRE-CONDITIONING
   B. POLARIZING VOLTAGE (50% OF RATED D.C. VOLTAGE IS 50VDC ON SAMPLES 225-230).
   C. STEPS 7A AND 7B ARE APPLICABLE.

2. UPON REMOVAL FROM THE CHAMBER THE SAMPLES SHALL BE CONDITIONED AT A TEMPERATURE OF 25 ± 5°C AND A RELATIVE HUMIDITY OF 50 ± 5% FOR A PERIOD OF NOT LESS THAN 22 HOURS NOR MORE THAN 24 HOURS.

3. WITHIN 24 HOURS AFTER THE COMPLETION OF THE CONDITIONING PERIOD, THE SAMPLES SHALL BE RETURNED TO CUSTOMER.

4. RECORD ALL DATA.

DATE STARTED: 10-13-66	PARTS TEST DATA	TEST ENGINEER: [illegible]
DATE COMPLETED: 10-25-66	SPECIMEN DESCRIPTION: CAPACITOR	GROUP LEADER: W. [illegible]
TEMP: NOTED	TEST: 5. MOISTURE RESISTANCE	SPECIFICATION MIL-STD-202B METHOD 106A
HUMIDITY: NOTED	VENDOR: ARING RESEARCH CORP.	

C. TEST RESULTS --- EXPOSURE TABLE

STEP --FV. 10-55-10

--DA 0.06 TEXT NOT REPRODUCIBLE

DATE	TIME	TA	RH		STEP	CYCLE	SAMPLE	COMMENT
	--	65	95.		1-7	1-10		SPECIFIED
10-13-66	1600	50	—				355-380	BEGAN CONDITIONING
10-14-66	1600	50	—					ENDED CONDITIONING
10-14-66	1630	25	--		1	1		CHAMBER ON
	1830	65	95		2			CONDITIONS MET
	2130	65	95		3			HEAT OFF
10-14-66	2400	25	--		4			HEAT ON
10-15-66	0230	65	95		5			CONDITIONS MET
	0550	65	95		6			HEAT OFF
	0800	25	95		7			BEGIN STEP 7
	1000	-10	--		7A			BEGIN STEP 7A
	1300	-10	--		7A			END STEP 7A
	1305	---	--		7B			BEGIN STEP 7B
	1330	--	--		7B	1		END STEP 7B
10-15-66	1600	--	--		1-7	2		REPEAT CYCLE 1
10-16-66	1600	--	--			3		
10-17-66	1600	--	--			4		
10-18-66	1600	--	--			5		
10-19-66	1600	--	--			6		
10-20-66	1600	--	--			7		
10-21-66	1600	--	--			8		
10-22-66	1600	--	--			9		
10-23-66	1600	--	--			10		REPEAT CYCLE 1
10-24-66	0800	--	--		7	10	355-380	END CYCLE 10 AND MOIST. RES. TEST

STEPS: 7A AND 7B CONDUCTED DURING CYCLES 4 5 6 7 8

VISUAL EXAMINATION FOLLOWING HUMIDITY:

THERE WAS NO EVIDENCE OF PHYSICAL DAMAGE OR CORROSION.

NOTE: SAMPLES WERE CONDITIONED AT 25 °C, 50% RELATIVE HUMIDITY FROM 0800, 10/24/66 TO 0800 10/25/66. SAMPLES RETURNED TO ARING 0900, 10/25/66.

DATE STARTED: 10/13/66	PARTS TEST DATA	TEST ENGINEER: D. F. SMEAL
DATE COMPLETED: 10/25/66	SPECIMEN DESCRIPTION: CAPACITORS, POLYCARBONATE	GROUP LEADER: W WALTT
TEMP: —	TEST: 5.) MOISTURE RESISTANCE	
HUMIDITY: —	VENDOR: ARINC RESEARCH CORP.	

CONCLUSION:

SINCE THERE WAS NO EVIDENCE OF PHYSICAL DAMAGE, EXCESSIVE CORROSION, OR ELECTRICAL BREAKDOWN, THE SAMPLES MET THE REQUIREMENTS OF THE MOISTURE RESISTANCE TEST.

RECOMMENDATIONS:

NONE. DATA MERELY RECORDED.

APPENDIX I

ITEMIZED DESCRIPTION
OF EQUIPMENT USED TO
PERFORM TESTS

THE INSTRUMENTATION USED IN THE PERFORMANCE OF THESE TESTS IS PERIODICALLY CALIBRATED AND STANDARDIZED WITHIN MANUFACTURER'S RATED ACCURACIES BY AN AIR FORCE APPROVED CALIBRATION LABORATORY. CERTIFICATION OF CALIBRATION IS ON FILE SUBJECT TO INSPECTION BY REQUEST.

EQUIPMENT LIST

Description	Symbol	Unit	Apparatus	Calibration
1. Barometric Pressure			A. Chamber, Altitude, High & Low Temperature, Leatherman-Controlled by Minneapolis-Honeywell Conroller-Recorder Model TMST 100 350, Accuracy 1%, AEI No. 5000	6 months 8-28-66 to 2-28-67
			B. Power Supply, D.C., Dressen-Barnes, Model 5-300B, AEI No. 5292	3 months 7-18-66 to 10-18-66
			C. Voltmeter, D.C., Sensitive Research, Model University Accuracy 0.5%, AEI No. 5510	3 months 8-15-66 to 11-15-66
2. Shock			Same as Item 1.B - Power Supply	
			A. Oscillator, Hewlett Packard Model 200AB, Accuracy 2% AEI No. 5239, x10	6 months 10-11-66 to 4-11-67
			B. VTVM, Hewlett Packard, Model 410B, 300, Accuracy 3% AEI No. 5154	3 months 8-30-66 to 11-30-66
			C. VTVM, Hewlett Packard, Model 400H, 3, Accuracy 1%, AEI No. 5151	3 months 9-7-66 to 12-7-66
			Same as Item 1.C - Voltmeter	
			D. Oscilloscope, Tektronix Model 515A-S1, .05v/cm, .2 mils/cm, AEI No. 5159	3 months 7-25-66 to 10-25-66
			E. Shock Tower, Leatherman Sand Drop, Model MS-44562, accuracy 10%, AEI No. 5044	Checked prior to test
3. Vibration			Same as Item 1.B - Power Supply	
			Same as Item 2.A - Oscillator	
			Same as Item 2.B - VTVM	
			Same as Item 2.C - VTVM	
			Same as Item 1.C - VTVM	
			Same as Item 2.D - Oscilloscope	

DESCRIPTION	SYMBOL	UNIT	APPARATUS	CALIBRATION
3. VIBRATION (CONTINUED)				
A. AMBIENT TEMPERATURE	T_A	•	MERCURY THERMOMETER 0-200 x 2 °F.	N/A
B. VIBRATION SYSTEM	-	-	MB VIBRATION SYSTEM, AMPLIFIER TYPE T115MC, OSCILLATOR MODEL N570, EXCITER HEAD, MODEL C10E 1200 FORCE POUNDS: 1.0 INCH DOUBLE AMPLITUDE, 5-3000 CPS AEI NO. 5203	6 MONTHS 5-19-66 TO 11-19-66
C. FREQUENCY OF VIBRATION	F_V	CPS	MB FREQUENCY INDICATOR MODEL 1050, ACCURACY ±2%	CHECKED PRIOR TO TEST
D. DOUBLE AMPLITUDE	D_A	INCH	INTERNAL VELOCITY NETWORK, MFG. BY M.B. ELEC.	CHECKED PRIOR TO TEST
E. INPUT ACCELERATION	G	GRAVITY	ENDEVCO ACCELEROMETER, MODEL 2215,C, FREQUENCY 2% AMPLITUDE 2%, AEI NO. 5557	6 MONTHS (CHECKED PRIOR TO TEST) 5-17-66 TO 11-17-66
4. SALT SPRAY				
A. AMBIENT TEMPERATURE	T_A	°F	PUMP AND FILTER MFG. CO., SALT SPRAY CHAMBER, MODEL CA1, S/N 3035	CHECKED PRIOR TO TEST
B. NOZZLE PRESSURE	P_N	PSI	NORDEN-KETAY CO., PRESSURE GAUGE, AEI NO. 5391, 0-30 x 1/2 PSIG	6 MONTHS 4-29-66 TO 10-29-66
C. NACL CONTENT OF FOG	FOG	PERCENT	NACL AND DISTILLED WATER BY WEIGHT	
D. ATOMIZATION-COLLECTION PER 80 SQ. CM AREA	A	MILLI-LITRE	(2) FUNNELS, PLASTIC, 80 SQ. CM INLET AREA (2) EXAX TD 20°C, GRADUATED BEAKER, 200 x 2 MILLILITRES	

EQUIPMENT LIST (CONTINUED)

DESCRIPTION	SYMBOL	UNIT	APPARATUS	CALIBRATION
4. SALT SPRAY (CONTINUED)				
E. FOG DENSITY	D_F	SPECIFIC GRAVITY	SPECIFIC GRAVITY SCALE, 1,000 TO 1,220, NO. 5820-H	
F. HYDROGEN ION CONTENT	PH	PH	BECKMAN, PH METER, MODEL "N", S/N 123550	3 MONTHS
5. MOISTURE RESISTANCE				
			A. POWER SUPPLY, D.C., DRESSEN BARNES, MODEL 3-150L, 0-300 AEI NO. 5186	3 MONTHS 11-15-66 TO 2-15-67
			SAME AS ITEM 2.B - VTVM	
			B. VIBRATION SYSTEM, ALL AMERICAN, MODEL 25 HAD 0-55 CPS, AEI NO. 5206	CHECKED PRIOR TO TEST
			SAME AS ITEM 1.A - ALTITUDE CHAMBER	

SERVICE FOR:

ARINC RESEARCH CORPORATION
1222 EAST NORMANDY PLACE
SANTA ANA, CALIFORNIA

PURCHASE ORDER NO. Y 2655

I HEREBY CERTIFY THAT THE PRECEDING REPORT IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE.

AMERICAN LABORATORIES

Neal D. Nelson
NEAL D. NELSON
TECHNICAL DIRECTOR

SUBSCRIBED AND SWORN TO BEFORE ME THIS 27TH DAY OF OCTOBER 1966

RUTH VANDERGRIFT
NOTARY PUBLIC CALIFORNIA
PRINCIPAL OFFICE IN
ORANGE COUNTY

Ruth Vandergrift
RUTH VANDERGRIFT, NOTARY PUBLIC IN AND FOR THE COUNTY OF ORANGE, STATE OF CALIFORNIA. MY COMMISSION EXPIRES AUGUST 2, 1968

Joe L. Majlish
J. L. MAJLISH
AMERICAN LABORATORIES
QUALITY CONTROL

BP

APPENDIX D
CONSTRUCTION TECHNIQUES, METALLIZED POLYCARBONATE CAPACITORS

The construction process can be summarized as follows:

(1) Material: The dielectric is a polycarbonate resin, which is a polymerized carbonic acid ester of a bispheral. The resin, which is in a chloroform solution, is applied to a support of polyethylene terephthalate and dried by being passed near a set of infrared lamps.

(2) Preparation of dielectric material: A thin aluminum film is deposited on the resin by vacuum metallization. The material is slit to the desired width, and the 0.12-mil metallized polycarbonate lacquer film is stripped (or mechanically separated) from the backing.

(3) Assembly: A tangential winding machine is used for winding the metallized film into capacitors. To support the fragile film during winding, the supply rolls are kept in contact with the mandrel. These variables were controlled "by hand".

(4) Attachment of terminals: To permit attachment of the leads to the foil roll, a conductive slurry was sprayed onto the ends of the roll. Next, the roll was encased in an insulating material to prevent shorting of the capacitor to the metal casing. The roll was then slipped into the metal casing, the terminals were soldered to the ends of the roll, and the casing was sealed by soldering. The capacitor roll from the casing was accomplished by placing a very thin layer of insulating material around the interior of the metal casing, and then filling the intervening space between the capacitor roll and the casing with oil. The vendor also "crimped" the edges of the metal sleeving prior to soldering in order to hold the assembly together.

76

APPENDIX E

RAW DATA FROM LABORATORY EVALUATION

Test Performed: Initial Measurements-GP-I

EVALUATION TEST DATA

Capacitor Type 483G

Date 9-7-66
Technician L. W. Dur...
Engineer G. Snider

Test Device S/N	Mfr.	Parameter Test Results: Dielectric Withstanding Voltage	Insulation Resistance in megohms	Capacitance in µF	Dissipation Factor	Seal	Insulation Resistance @+125°C in megohms	Length in inches	Outer Diameter in inches
201	TRW	OK	>100K megohms	0.0960	0.0001	ok	7.15K	.884	.400 ✓ S.S
202		OK		0.0955	0.0002	OK	9.10K	.884	.400 P.H ✓ S.S
203		OK		0.0960	0.0002	ok	5.25K	.882	.400 ✓ S.S
204		OK		0.0955	0.0001	ok	9.05K	.882	.400 ✓
205		OK	5.0 K	0.0951	0.0001	ok	2.00K	.882	.398
206		OK	>100K	0.0956	0.0002	ok	10.0K	.881	.400 ✓ S.S
207		OK		0.0959	0.0001	ok	7.6K	.880	.400 ✓ S.S
208		OK		0.0952	0.0001	ok	6.26K	.879	.400 ✓
209		OK		0.0942	0.0002	ok	9.08K	.881	.400 ✓ S.S
210		OK		0.0952	0.0002	ok	6.22K	.886	.400 PH ✓
211		OK		0.0959	0.0001	ok	5.89K	.880	.400 PH ✓
212		OK		0.0959	0.0001	ok	9.04K	.880	.400 ✓
213		OK		0.0957	0.0002	ok	6.67K	.881	.400 PH ✓ S.S
214		OK		0.0955	0.0001	ok	10.0K	.881	.400 ✓ S.S
215		OK		0.0955	0.0001	ok	7.15K	.882	.400 ✓ S.S
216		OK		0.0952	0.0002	ok	6.67K	.881	.400 ✓
217		OK		0.0960	0.0001	ok	4.0K	.880	.400 ✓
218		OK		0.0960	0.0003	ok	3.7K	.884	.400
219		OK		0.0960	[illegible]	[illegible]	[illegible]	.881	.400 ✓

Test Performed:
Initial Measurements · GP-J

EVALUATION TEST DATA

Capacitor Type 483G

Date 9-7-66
Technician L. J. Dyma
Engineer G. Snider

Test Device S/N	Mfr.	Parameter Test Results							
		DIELECTRIC WITHSTANDING VOLTAGE	INSULATION RESISTANCE	CAPACITANCE IN UF	DISSIPATION FACTOR	SEAL	INSULATION RESISTANCE @+125°C	LENGTH IN INCHES	OUTER DIAMETER IN INCHES
239	TRW	OK	7100K	0.0951	0.0005	√		.881	.400

EVALUATION TEST DATA

Test Performed:
GP II - S/N 231-236 AFTER SHOCK, VIBRATION, & SALT SPRAY
GP III - S/N 225-230 AFTER MOISTURE RESISTANCE

Capacitor Type 483G

Date 10-26-66
Technician L. J. Duran
Engineer G. L. Snider

Test Device S/N	Mfr.	Parameter Test Results: DISSIPATION FACTOR @ +25°C	CAP IN μF @ +25°C	TERM-CASE INSUL RESIST. @ +25°C IN MEGOHMS	TERM-CASE INSUL RESIST @ +125°C	LENGTH IN INCHES	OUTER DIAMETER IN INCHES	TERM-TERM [illegible] IN MEGOHMS	TERM-TERM [illegible] RESIST @ +125°C IN MEGOHMS
225	TRW	.0001	.0956	>100K	7.14K	.880	.376	>100K	4.78K
226		.0001	.0959		5.26K	.881	.398		3.71K
227		.0001	.0960		7.69K	.879	.402		5.25K
228		.0002	.0961		1.59K	.884	.399		1.39K
229		.0002	.0935	50K	4.00K	.880	.398		2.86K
230		.0001	.0962	33.0K	2.94K	.878	.398		2.78K
231		.0003	.0961	>100K	9.10K	.881	.399		5.55K
232		.0001	.0955		8.32K	.880	.400		5.25K
233		.0001	.0960		9.10K	.883	.398		5.25K
234		.0003	.0959		9.10K	.881	.399		6.25K
235		.0002	.0955		10.0K	.880	.399		6.25K
236		.0004	.0950		5.89K	.880	.398		4.53K

EVALUATION TEST DATA

Test Performed:
GPII - AFTER TEMPERATURE [illegible]

Capacitor Type 4336

Date [illegible]
Technician L. J. Dunn
Engineer G. L. [illegible]

Test Device S/N	Mfr.	Parameter Test Results							
		DISS FACTOR [illegible]	CAP [illegible]	INSUL RESIST @ +25°C IN MEGOHMS	INSUL RESIST @ +125°C IN MEGOHMS	LENGTH	OUTER DIAMETER		
231	TRW	.0006	.0979	>100K	8.7K	.880	.397		
232		.0002	.0968		9.01K	.880	.399		
233		.0005	.0973		9.07K	.881	.398		
234		.0003	.0972		9.07K	.879	.398		
235		.0002	.0970		8.32K	.879	.398		
236		.0001	.0960		8.32K	.879	.398		

EVALUATION TEST DATA

Test Performed: Solderability - GP-III

Capacitor Type 483 L

Date 9-29-66
Technician
Engineer G. L. SNIDER

Test Device S/N	Mfr.	Parameter Test Results							
		Solder Appearance		Capacitance in uF	Dissipation Factor				
225	TRW	acceptable		.0955	.0001				
226		acceptable		.0956	.0007				
227		10% [illegible] – acceptable		.0956	.0001				
228		20% [illegible] unacceptable		.0959	.0004				
229		30% [illegible] unacceptable		.0931	.0002				
230		acceptable		.0960	.0002				

MICROFILM LEGIBILITY IS THE BEST POSSIBLE FROM THE ORIGINAL REPORT QUALITY

TEXT NOT REPRODUCIBLE

82

Test Performed:
TERMINAL STRENGTH - GP-III

EVALUATION TEST DATA

Capacitor Type 4836

Date 9-29-6[illegible]
Technician L. J. Duran
Engineer G. L. SNIDER

Test Device S/N	Mfr.	Parameter Test Results: TWIST TEST	CAPACITANCE IN μf	DISSIPATION FACTOR					
225	TRW	OK	.0955	.0001					
226			.0955	.0005					
227			.0958	.0001					
228			.0959	.0003					
229			.0929	.0002					
230			.0961	.0003					

EVALUATION TEST DATA

Test Performed: Low Temperature, & Capacitance - GP-VI Change with Temperature

Capacitor Type 483G

Date 9-26-66
Technician L. J. Duran
Engineer G. Snider

Test Device S/N	Mfr.	Parameter Test Results: Capacitance in µf @ -65°C	Capacitance in µf @ +25°C	Capacitance in µf @ +125°C	Capacitance in µf @ +25°C				
201	TRW	.098	.0975	.0960	.0975				
202		.0975	.0970	.0959	.0970				
203		.098	.0975	.0960	.0975				
204		.098	.0970	.0955	.0970				
205		.097	.0970	.0959	.0970				
206		.098	.0970	.0960	.0970				
207		.098	.0975	.0960	.0975				
208		.097	.0970	.0955	.0970				
209		.097	.0960	.0950	.0960				
210		.0975	.0970	.0959	.0970				
211		.0975	.0970	.0955	.0970				
212		.0985	.0980	.0960	.0980				
213		.0980	.0970	.0960	.0970				

84

Test Performed:
LOW TEMPERATURE, CAPACITANCE GP IV
CHANGE WITH TEMPERATURE

EVALUATION TEST DATA

Capacitor Type 483G

Date 10-18-66
Technician L. J. Duran
Engineer G. SNIDER

Test Device S/N	Mfr.	Parameter Test Results: CAP. IN uf @-65°C	CAP. IN uf @+25°C	CAP. IN uf @+125°C	CAP. IN uf @+25°C				
214	TRW	.0978	.0968	.0955	.0972				
215		.0970	.0965	.0955	.0970				
216		.0978	.0965	.0955	.0970				
217		.0980	.0972	.0960	.0977				
218		.0975	.0970	.0960	.0975				
219		.0980	.0975	.0961	.0979				
220		.0982	.0975	.0961	.0980				
221		.0965	.0959	.0949	.0960				
222		.0980	.0975	.0965	.0979				
223		.0975	.0970	.0959	.0975				
224		.0962	.0959	.0950	.0961				

EVALUATION TEST DATA

Test Performed: TEMPERATURE COEFFICIENT GP-IV

Capacitor Type 483G

Date 10-21-66
Technician L. J. Duran
Engineer G L. Snider

Test Device S/N	Mfr.	Parameter Test Results								
		CAP. IN µf @ +25°C	CAP. IN µf @ -55°C	CAP. IN µf @ -15°C	CAP. IN µf @ +25°C	CAP. IN µf @ +40°C	CAP. IN µf @ +75°C	CAP. IN µf @ +100°C	CAP. IN µf @ +125°C	CAP. IN µf @ +25°C
214	TRW	.0969	.0980	.0978	.0970	.0967	.0962	.0960	.0957	.0975
215		.0965	.0976	.0975	.0965	.0965	.0961	.0959	.0955	.0971
216		.0970	.0979	.0978	.0970	.0965	.0961	.0960	.0959	.0972
217		.0974	.0981	.0980	.0975	.0971	.0968	.0965	.0962	.0979
218		.0970	.0975	.0978	.0972	.0971	.0969	.0965	.0962	.0975
219		.0975	.0981	.0980	.0979	.0975	.0971	.0970	.0967	.0980
220		.0975	.0990	.0985	.0979	.0975	.0972	.0967	.0963	.0982
221		.0959	.0969	.0965	.0959	.0958	.0955	.0952	.0949	.0961
222		.0976	.0982	.0982	.0978	.0975	.0972	.0970	.0965	.0980
223		.0970	.0980	.0978	.0971	.0970	.0965	.0961	.0960	.0975
224	↓	.0960	.0970	.0966	.0960	.0959	.0955	.0954	.0950	.0962

EVALUATION TEST DATA

Test Performed:
LIFE TEST (INITIAL MEASUREMENTS) SM IV Capacitor Type 483G

0 Hrs.

Date 9-29-66
Technician L. J. Duran
Engineer G. Snider

Test Device S/N	Mfr.	Parameter Test Results DISSIPATION FACTOR	CAPACITANCE µf	INSULATION RESISTANCE IN MEGOHMS					
201	TRW	.0002	.0975	>100K					
202		.0003	.0971						
203		.0001	.0975						
204		.0002	.0971						
205		.0002	.0970						
206		.0004	.0975						
207		.0001	.0977						
208		.0002	.0966						
209		.0001	.0961						
210		.0002	.0969						
211		.0002	.0970						
212		.0002	.0979						
213		.0001	.0972						

EVALUATION TEST DATA

Test Performed: LIFE TEST (50HR. MEASUREMENTS) 6 PC IV

Capacitor Type 4836

Date 10-3-66

Technician L. W. Duran

Engineer G. L. Smiley

Test Device S/N	Mfr.	60 HRS Dissipation Factor	60 HRS Capacitance µf	100 HRS Dissipation Factor	100 HRS Capacitance µf	150 HRS Dissipation Factor	150 HRS Capacitance µf	200 HRS Dissipation Factor	200 HRS Capacitance µf
201	TRW	.0002	.0972	.0001	.0971	.0001	.0970	.0001	.0970
202		.0001	.0969	.0002	.0963	.0002	.0962	.0002	.0965
203		.0001	.0972	.0003	.0971	.0002	.0964	.0002	.0970
204		.0001	.0970	.0001	.0970	.0002	.0965	.0002	.0970
205		.0002	.0969	.0003	.0965	.0002	.0963	.0003	.0965
206		.0001	.0972	.0001	.0970	Short TF	100/150 HRS		
207		.0001	.0975	.0002	.0975	.0001	.0970	.0001	.0971
208		.0001	.0966	.0001	.0965	.0001	.0962	.0001	.0962
209		.0001	.0961	.0001	.0961	.0001	.0960	.0001	.0960
210		.0002	.0968	.0002	.0965	.0002	.0962	.0002	.0962
211		.0001	.0965	.0001	.0966	.0002	.0962	.0001	.0966
212		.0002	.0978	.0002	.0978	.0002	.0972	.0002	.0971
213		.0001	.0971	.0001	.0970	.0001	.0970	.0001	.0970

EVALUATION TEST DATA

Test Performed: LIFE TEST (FINAL MEASUREMENT) GP-III

Capacitor Type 483G

Date 10-17-66

Technician L. J. Duran

Engineer G. L. Singer

Test Device S/N	Mfr.	Parameter Test Results: DISSIPATION FACTOR	CAPACITANCE µf	INSULATION RESISTANCE IN MEGOHMS	INSULATION RESISTANCE IN MEGOHMS	LENGTH IN INCHES	OUTER DIAMETER IN INCHES		
201	TRW	.0002	.0970	>15K	12 MEGOHMS	LEAKAGE OF IMPREGNANT			
202		.0002	.0962		>100K	.890	.400		
203		.0003	.0969			.882	.398		
204		.0001	.0965			.881	.397		
205		.0004	.0964	50K		.884	.398		
206		SHORTED	100/150HRS.	—	—	—	—		
207		.0001	.0970	>100K	>100K	.879	.397		
208		.0001	.0962			.881	.397		
209		.0002	.0960			.879	.397		
210		.0004	.0962			.884	.398		
311		.0002	.0965			.881	.398		
212		.0001	.0973		HIGH LEAKAGE 2 MEGOHMS	LEAKAGE OF IMPREGNANT			
213		.0002	.0970		>100K	.900	.397		

MICROFILM LEGIBILITY IS THE BEST POSSIBLE FROM THE ORIGINAL REPORT QUALITY

TEXT NOT REPRODUCIBLE

19

EVALUATION TEST DATA

Test Performed:
LIFE TEST (INITIAL MEASUREMENTS) GP-II

64 Hrs

Capacitor Type 483G

Date 11-3-66
Technician L. J. Duren
Engineer G. L. Snider

Test Device S/N	Mfr.	Parameter Test Results							
		DISS. FACTOR	CAP. IN μf	INSUL RESIST IN MEGOHMS					
214	TRW	.0003	.0970	>100L					
215		.0003	.0968						
216		.0001	.0970						
217		.0004	.0974						
218		.0003	.0971						
219		.0002	.0975						
220		.0001	.0979						
221		.0002	.0959						
222		.0003	.0978						
223		.0001	.0970						
224		.0002	.0960						

EVALUATION TEST DATA

Test Performed: LIFE TEST (50HR. MEASUREMENTS) GP. IV

Capacitor Type 4836

Date 11-7-66

Technician L. J. Dunn

Engineer G. L. Snider

Test Device S/N	Mfr.	Parameter Test Results 50 HRS DISS. FACTOR	50 HRS CAP. IN µf	100 HRS DISS. FACTOR	100 HRS CAP. IN µf	150 HRS DISS. FACTOR	150 HRS CAP. IN µf	200 HRS DISS. FACTOR	200 HRS CAP. IN µf
214	TRW	.0001	.0970	.0001	.0970	.0001	.0969	.0001	.0970
215		.0002	.0965	.0003	.0965	.0002	.0962	.0001	.0963
216		.0003	.0965	.0002	.0965	.0001	.0966	.0002	.0969
217		.0002	.0973	.0001	.0971	.0001	.0974	.0001	.0971
218		.0004	.0970	.0001	.0970	.0004	.0970	.0004	[illegible]
219		.0002	.0974	.0002	.0974	.0001	.0974	.0003	.0973
220		.0002	.0975	.0002	.0974	.0003	.0974	.0003	.0974
221		.0004	.0955	.0001	.0956	.0002	.0955	.0003	.0956
222		.0003	.0975	.0004	.0977	.0005	.0975	.0006	.0975
223		.0003	.0970	.0006	.0970	.0002	.0969	.0004	.0967
224		.0002	.0959	.0001	.0958	.0001	.0958	.0002	.0958

EVALUATION TEST DATA

Test Performed: LIFE TEST (FINAL MEASUREMENTS) GP-II

Capacitor Type 483G

Date 11-21-66
Technician
Engineer G. L. Snider

Test Device S/N	Mfr.	Parameter Test Results 250 [illegible] DISS. FACTOR	CAP. IN µf	INSUL. RESIST. [illegible]		LENGTH	OUTER DIAMETER		
214	TRW	[illegible]	[illegible]	> [illegible]		.891	.397		
215		[illegible]	[illegible]			.882	.399		
216		[illegible]	[illegible]			.882	.398		
217		[illegible]	[illegible]			.875	.398		
218		[illegible]	[illegible]			.891	.397		
219		[illegible]	[illegible]			.880	.397		
220		[illegible]	.0771			.881	.398		
221		[illegible]	[illegible]			.879	.397		
222		[illegible]	[illegible]			.886	.398		
223		[illegible]	[illegible]			.879	.398		
224		0	[illegible]			.891	.398		

TEXT NOT REPRODUCIBLE

92